SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

FRIDAY, JANUARY 15, 1904.

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MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

PROCEEDINGS OF THE ST. LOUIS MEETING.

THE fifty-third annual meeting of the American Association for the Advancement of Science was held in St. Louis, December 26, 1903, to January 1, 1904. This was the second time the association had met in St. Louis, the first being the twenty-seventh meeting in 1878. The association has met west of the Mississippi but six times.

The number of members in attendance was 385, while the number in the affiliated societies was 81, making a total attendance of 466. This places the meeting fifth in point of numbers of those held during the last ten years. As the total membership has rapidly increased in this time, this would seem to be a small meeting, but there are various reasons to account for it. The first and strongest of them is that the exposition will be held in St. Louis next summer and a large number of the members expect to visit the city at that time. Hence they did not feel like going to St. Louis in the winter, notwithstanding their strong desire to attend the meeting of the association.

Although the meeting was small in point of numbers, it was large in point of papers and earnest work in the section room. Many of the sections were very largely attended and had so many papers that they could not complete them during the regular time assigned. Several evening meetings were held, and at least two of the sections held meetings after the final adjournment of the association. This shows that the

meeting was what might be called a working meeting. Those who had papers to present were there and took active part in the proceedings. It was unfortunate that a larger number could not have been present, but any meeting at which a large number of papers is presented, and where a strong and vital interest is taken in the work of the section room must be called a successful one.

Perhaps the second reason why the attendance was small was in the fact that the policy of the association, which calls for working meetings, does not meet hearty support from all of the members. There is still some discussion going on as to whether it would be better to have a summer meeting or a winter meeting, or perhaps both. Some of the older members do not feel like traveling long distances during the winter and subjecting themselves to the changes of temperature and other discomforts which come from winter travel. In some cases it is not possible for college professors to get away from their institutions during the week of the meeting, and still others do not like to leave their families during the holiday vacation. On the other hand, the majority of those present seemed to feel that it was best to continue the present method, for a time at least. There was no open opposition to the winter sessions, and when the vote was taken in the general committee the winter meeting for next year was unanimously decided upon.

Winter meetings do not readily lend themselves to excursions. The time must be taken up in the reading and discussion of papers, and the social element must come in the form of banquets and smokers. St. Louis did all in its power to entertain the convention, and several excursions were arranged, notwithstanding the unfavorable season.

AFFILIATED SOCIETIES.

The following affiliated societies held meetings in conjunction with the association:

The American Anthropological Association.
The American Chemical Society.
The American Mathematical Society (Chicago Section).
The American Microscopical Society.
The American Physical Society.
The American Psychological Association.
The American Society of Naturalists.
The American Society of Zoologists (Central Branch).
The Association of Economic Entomologists.
The Association of Plant and Animal Breeders.
The Astronomical and Astrophysical Society of America.
The Botanical Club of the Association.
The Botanical Society of America.
The Central Botanists' Association.
The Entomological Club of the Association.
The Fern Chapter.
The Geological Society of America.
The Sigma Xi Honorary Scientific Society.
The Society for Horticultural Science.
The Society for the Promotion of Agricultural Science.
The Wild Flower Preservation Society of America.

The policy of encouraging the affiliation of scientific societies with this association has been continued, and two more societies, the Society of College Teachers of Education and the Society for Horticultural Science, have been added to the list. Some of the strongest of the affiliated societies have not sought any connection with this association. It would seem that an earnest effort should be made to bring about some connection between these organizations and our own. 'In union there is strength.' The scientific forces of the country should stand together, and whenever it comes that assistance is needed for scientific research, or favorable legislation is needed for any purpose, it will be obtained much more readily if it is known that practically all the scientists of the country are back of the association which asks for such action.

The first session of the meeting was called

to order in the auditorium of the Central High School, at 10 A.M., Monday, December 28, 1903, by the retiring president, Dr. Ira Remsen.

Dr. Remsen introduced the president-elect, Dr. Carroll D. Wright. Addresses of welcome were then made by the Hon. D. R. Francis on behalf of the local committee, by the Hon. C. P. Walbridge on behalf of the city of St. Louis, and by Professor C. M. Woodward on behalf of the educational institutions of the city and the state. To these addresses President Wright replied for the association.

President Wright announced that each day the council would meet at nine o'clock and the general session at ten o'clock.

After the adjournment of the general session the several sections were organized in their respective rooms.

On Monday afternoon the vice-presidents' addresses were given as follows:

At 2:30 P.M.

Vice-President Halsted before the Section of Mathematics and Astronomy, in Room B2, entitled 'The Message of Non-Euclidean Geometry.'

Vice-President Baskerville before the Section of Chemistry, in Room 102, entitled 'The Elements: Verified and Unverified.'

Vice-President Davis before the Section of Geology, in Room 202, entitled 'Geography in the United States.'

At 4:00 P.M.

Vice-President Waldo before the Section of Mechanical Science and Engineering, in Room 310.

Vice-President Hargitt before the Section of Zoology, in Room 202, entitled 'Some Unsolved Problems of Organic Adaptation.'

Vice-President Coville before the Section of Botany, in Room 102.

Vice-President Newcomb before the Section of Social and Economic Science, in the auditorium, entitled 'Some Recent Phases of the Labor Problem.'

The address of Vice-President Nichols before the Section of Physics was omitted, owing to the absence of Mr. Nichols, who was detained by sickness in his family.

On Monday evening the address of the retiring president, Dr. Ira Remsen, entitled 'Scientific Investigation and Progress,' was given at the Odeon.

On Tuesday evening, President David Starr Jordan, of Leland Stanford Junior University, gave a public lecture on 'The Resources of Our Seas.' After the lecture the American Society of Naturalists and affiliated societies held their annual smoker at the University Club.

On Wednesday morning Dr. George A. Dorsey delivered his address as retiring president of Section H, upon the subject 'The Future of the American Indian.'

On Wednesday afternoon the American Society of Naturalists held their annual public discussion, the subject being 'What Academic Degrees should be conferred for Scientific Work?'

On Wednesday afternoon Professor E. Rutherford, of McGill University, Montreal, Canada, gave an illustrated public lecture on the subject 'Radium and Radioactivity.'

On Wednesday evening the retiring president of the American Chemical Society, Dr. John H. Long, delivered an address upon the subject 'Some Problems in Fermentation.'

On Wednesday evening the American Society of Naturalists held its annual dinner at the Mercantile Club, after which was given the address of the retiring president, Professor William Trelease.

On Wednesday evening the annual dinner of the American Chemical Society and Section C was given at Faust's.

On Wednesday evening Dr. S. F. Emmons gave the president's address before the Geological Society of America at the Planters' Hotel.

On Thursday afternoon, by invitation of the officers of the Louisiana Purchase Exposition, the members of the association and affiliated societies visited the exposition grounds. A buffet luncheon was tendered the association by the officers of the exposi-

tion, after which they were taken in small parties through the grounds and buildings and shown the various exhibits, under the personal charge of the chiefs of departments.

On Thursday evening the annual banquet of the Sigma Xi Honorary Scientific Society was given at the Mercantile Club, followed by the address of President David Starr Jordan.

On Friday evening the members of the association attended the fourteenth annual banquet given by the trustees of the Missouri Botanical Garden at the Southern Hotel.

REPORTS OF COMMITTEES.

The following reports of committees were presented to the council. They were accepted and ordered printed.

On the Atomic Weight of Thorium.

To the Council of the American Association for the Advancement of Science.

Gentlemen: Since our last report we beg leave to state that Messrs. Charles Baskerville and R. O. E. Davis have secured further evidence of the complexity of the so-called element, thorium. This work has resulted from applications of methods of fractionation to the large amounts of purified material with which they were engaged, as stated in our last report. Under such circumstances these gentlemen deemed it advisable to prosecute further the fractionation until a stable thorium preparation was secured. This fractionation is controlled by atomic weight determinations and spectroscopic examinations.

At the Washington meeting of the council, a grant of fifty dollars was made Mr. Charles Baskerville for work on præseodidymium and the supervision of the same given over to this committee. Concerning this, we beg leave to state that Messrs. Baskerville, James Thorpe and T. B. Foust have secured about one kilogram of quite pure oxide by novel methods. At present Messrs. Baskerville and G. MacNider are subjecting a considerable portion of this purified material to a treatment which promises to show the complexity of this so-called element.

We therefore, beg leave to report progress.

Respectfully,

Chas. Baskerville, *Chairman*,
Francis P. Venable,
Jas. Lewis Howe.

On the Relation of Plants to Climate.

Gentlemen: The committee on the relation of plants to climate presents herewith a paper entitled 'Soil Temperatures and Vegetation,' which sets forth recent results obtained by the aid of grants received in 1901 and 1902, and which was published in Contributions from the New York Botanical Garden (No. 44).

Your committee is desirous of extending the observations already made to cover a wider range of soil and climatic conditions, and has secured the cooperation of the New York Botanical Garden and of the Desert Botanical Laboratory of the Carnegie Institution, both of which have undertaken the purchase and installation of sets of instruments. The major inquiry is concerned with the influence of the temperature of soils, with its diurnal and seasonal variations, upon growth and distribution of plants. As a result of the observations already made it has been found that different portions of the body of even small plants may differ as much as 40° F. in temperature, a fact which has hitherto escaped notice and which promises to be of great importance in the interpretation of the physical processes of the plants. In order to carry along the entailed investigations, your committee asks an additional grant of seventy-five dollars.

During the course of the work, the Hallock soil thermograph has been invented and perfected. Specifications have been placed in the hands of a competent instrument maker, and no limitations of any kind placed on its manufacture or use. The numbers of applications for instruments show that it is deemed useful for thermometric work in various kinds of observations.

Respectfully,

D. T. MacDougal,
For the Committee.
William Trelease,
J. M. Coulter,
D. T. MacDougal,
Committee.

On Anthropometric Tests.

The committee of the association on anthropometric tests has continued its work throughout the year. A laboratory for physical and mental measurements was arranged at Washington, and tests of the fellows and members of the association were made by Mr. Miner and Mr. Davis under the direction of the chairman of the committee. The results of measurements of about one hundred fellows have been compiled and compared with similar measurements of members of the British Association and of other classes of the

community, but the data are not yet sufficiently numerous for publication. Dr. McGee, of the committee, has taken steps toward the establishment of anthropometric and psychometric laboratories as part of the Louisiana Purchase Exposition, with special reference to the measurement of the savage tribes that will be gathered there. Professor Boas, of the committee, has published measurements of the cephalic index in relation to Mendel's law, and has carried forward anthropometric work in other directions. The chairman of the committee has published two papers on the natural history of American men of science, seeking to apply metric methods to merit and other individual differences. Numerous measurements of physical and mental traits have been made in the psychological laboratory of Columbia University, and work has been carried on in the schools of New York City on the resemblance of brothers and twins, and in other directions. Professor Thorndike has published a book on 'Educational Psychology,' concerned especially with the application of anthropometric methods to children.

It did not appear feasible to arrange an anthropometric laboratory at St. Louis. We ask that the fifty dollars appropriated for such a laboratory be made available for next year.

J. MCKEEN CATTELL,
Chairman.

On Indexing Chemical Literature.

The committee on indexing chemical literature, appointed by your body at the Montreal meeting in 1882, respectfully presents to the Chemical Section its twenty-first annual report, covering the twelve months ending June 1, 1903.

Works Published.

'An Index to the Literature of Thorium (1817–1902).' By Cavalier H. Jouet, Ph.D. Smithsonian Miscellaneous Collections, No. 1374. Washington City, 1903.

'References to Capillarity to the End of the Year 1900.' By John Uri Lloyd (aided by Sigmund Waldbott). Bulletin No. 4 of the Lloyd Library of Botany, Pharmacy and Materia Medica. Cincinnati, Ohio, 1902. 8vo. 212 pp.

The 665 'references' extend from 1519 to 1900; each is accompanied by a summary of the contents of the paper cited.

The Journal of the American Chemical Society. General Index to the first twenty volumes, 1879–1898, and to the proceedings, 1877–1879. Easton, Pa., 1902. 8vo. 237 pp.

Though issued anonymously, the preface bears the initials of E. W. Morley and O. F. Tower, and the labor was one of love. Accuracy of detail and adequate treatment on every page are its admirable features. Besides an index of authors and an index of subjects, there is an index of obituaries which is suggestive. Also an index of new books.

Notes on Foreign Bibliographies.

'A Bibliography of Steel-works Analysis,' by Harry Brearly, forms an appendix to the volume entitled 'The Analysis of Steel-works Materials,' by Harry Brearly and Fred Ibbotson. London, 1902.

This bibliography comprises 1,858 references, which occupy more than 130 pages octavo. The items are grouped under seven heads, besides minor subdivisions; the literature is, however, very incomplete, being confined to four British journals.

'A Catalogue of the Library of the Chemical Society (of London).' Arranged according to authors with a subject index. London, 1903. 8vo. 342 pp.

'International Catalogue of Scientific Literature.' First Annual Issue (for the year 1901). D, Chemistry. Published for the International Council by the Royal Society of London. London, 1902. Vol. II., Part I. June, 1902.

Work in Progress.

A second supplement to the 'Select Bibliography of Chemistry,' by Dr. H. Carrington Bolton, has been completed and accepted for publication by the Smithsonian Institution. It brings the literature down to the end of the year 1902.

An index to the literature of cadmium has been begun by Professor Ernest N. Pattee, of Syracuse University.

An index to the literature of glucinum has been begun by Professor Charles L. Parsons, of New Hampshire College, Durham, New Hampshire.

An index to the literature of germanium, gallium and indium has been begun by Dr. Philip E. Browning, of New Haven, Connecticut.

Mr. Frank R. Fraprie, writing from Munich, Bavaria, reports substantial progress on an index to the literature of lithium, cæsium and rubidium.

Mr. Benton Dales is engaged on an index to the literature of the yttrium group of the rare earths. His address is Ithaca, New York.

H. CARRINGTON BOLTON (in Europe),
F. W. CLARKE (in Europe),
ALBERT B. PRESCOTT,
ALFRED TUCKERMAN,
H. W. WILEY,
Committee.

June 1, 1903.

On the Velocity of Light.

The committee reports progress since the Pittsburg meeting in the preliminary study of the methods of determining the group velocity and the absolute velocity of light in ponderable media and in space.

The practicability of the method, involving the use of electric double refraction and electric oscillations for producing groups of waves, and the examination of them through a column of water at least 100 feet long and probably twice that distance, has been established.

An estimate from the corresponding optical conditions in air would make the available distance several miles. The preliminary study of the method for determining the absolute velocity has not yet been completed, but the apparatus is partly mounted and in place.

The committee petitions a further grant of seventy-five dollars for the continuance of the preliminary experiments now in progress.

Respectfully submitted,

D. B. Brace,
For the Committee.

On the Teaching of Anthropology in America.

To the President and Council: Your committee on the teaching of anthropology in America beg to report progress.

During the year 1902 (for which a brief report was submitted to the council, though apparently lost before reaching the secretary of the council), the committee held one or two conferences, while different members took individual action in accordance with the general policy looking toward the promotion of anthropologic education in several leading institutions. Dr. MacCurdy, of the committee, continued the collection and publication of statistics as to the teaching of anthropology; and Dr. Boas, Dr. Russell and the chairman of the committee delivered addresses and published papers advocating the extension and betterment of anthropologic teaching in this country. During the year 1903 the committee have continued work, chiefly as individuals, and different members have been consulted and have expressed opinions as to the value of anthropology as a subject of instruction in educational institutions. Recently the committee has suffered a grievous loss in the death of Dr. Frank Russell, one of the original members of the committee.

It is recommended that the committee be continued, and that the vacancy created by the death of Dr. Russell be filled by the appointment of Dr. Roland B. Dixon, of Harvard University. Since the work of the committee is performed in occasional conferences and by correspondence, entailing little expense, no grant is asked for its maintenance.

Respectfully,

W J McGee, *Chairman.*
George Grant MacCurdy.

On Grants.

The committee on grants recommends that appropriations for the ensuing year be made as follows, namely:

To the Concilium Bibliographicum of Zurich, $100.

To the Committee on the Atomic Weight of Thorium, $100.

To the Committee on the Study of the Relations of Plants to Climate, $75.

To the Committee on Determination of the Velocity of Light, $75.

To a committee of Section C, to be appointed, to study certain problems in electrochemistry, $60.

To give effect to this last recommendation, the following resolution is suggested:

Resolved, That a committee consisting of Professors W. D. Bancroft, Edgar F. Smith and L. Kahlenberg be appointed to conduct said investigations in electrochemistry and that this committee be designated the Committee on Electrochemistry.

On Policy of the Association.

The Committee on Policy of the Association reported the following resolutions, which were adopted.

1. Concerning the proposition to authorize the appointment of an executive committee of five to consult with the permanent secretary and arrange details of the meetings, that the functions of such proposed executive committee be performed by the Committee on the Policy of the Association.

2. The Committee on the Policy of the Association recommend to the council that at the next annual meeting only three general sessions be held, namely, those of Monday, Wednesday and Friday of the week of meeting.

3. Amend Article 34 by the omission of the words 'on the election of any member as a fellow an additional fee of two dollars shall be paid.'

4. That the commutation of secretaries of sections be fixed at $30 for each meeting of the association, provided that these secretaries lodge during the whole meeting at the hotel headquarters of the association.

In regard to granting credentials to members of the association who wish to visit foreign associations, the committee recommended that all such applications be referred to the Committee on Policy, with power.

In regard to the application of the Society of College Teachers of Education and of the Society for Horticultural Science for affiliation with this association, the committee recommended that the applications be granted.

On the Relations of the Journal Science with the Association.

On the recommendation of the committee it was voted:

1. That the treasurer be added to this committee.

2. That the vice-presidents of the association and the permanent secretary be added to the editorial committee of the journal, SCIENCE.

On Amendments.

The following amendments to the constitution having been proposed at the Washington meeting, favorably acted upon by the council and reported to the general session were adopted:

Article 34, second line, change the word *assessment* to the word *dues.*

Article 35, first line, change the word *assessment* to the word *dues.*

Article 37, first line, change the word *assessment* to the word *dues.*

On Fellows

The following members were elected fellows of the association: Edward Goodrich Acheson, Victor C. Alderson, J. M. Allen, Frank Marion Andrews, Henry Prentiss Armsby, B. J. Arnold, Luigi d'Auria, Oscar Phelps Austin, Thomas M. Balliet, J. H. Barr, John Mallery Bates, Albert T. Bell, W. Z. Bennett, William B. Bentley, Bernard Arthur Behrend, Samuel Lawrence Bigelow, Charles Edward Brewer, W. K. Brooks, David I. Bushnell, Jr., Sidney Calvert, William E. Castle, Hubert Lyman Clark, Frederic Edward Clements, George E. Coghill, James Milnor Coit, Charles A. Conant, Robert A. Cooley, Henry Crew, William Crozier, Richard Sydney Curtiss, N. M. Fenneman, George Egbert Fisher, Moses Gomberg, Benjamin Feland Groat, Charles M. Hall, Fred DeForest Heald, George Grout Hedgcock, J. S. Hine, Frederick W. Hodge, S. J. Holmes, William Hoskins, Ira Woods Howerth, William James, John Black Johnston, Edwin S. Johonnott, Edward Kasner, Edward Keller, C. A. King, J. S. Kingsley, Martin A. Knapp, Charles M. Knight, Jesse Goad Land, A. S. Langsdorf, F. M. Leavitt, Felix Lengfeld, Victor Lenher, P. M. Lincoln, G. W. Littlehales, George Edwin McLean, Haven Metcalf, Robert Treat Paine, Charles J. Reed, Jacob Reighard, James Ford Rhodes, Isaac W. Riley, Samuel P. Sadtler, E. Dwight Sanderson, Homer LeRoy Shantz, John Lewis Sheldon, Bohumil Shimek, Edward Randolph Taylor, J. Bishop Tingle, Olin F. Tower, J. L. Van Ornum, F. L. O. Wadsworth, S. W. Williston and A. N. Winchell.

The following resolutions were proposed and adopted at the meeting of the general session held Friday, January 1:

In view of the extremely complete and effective arrangements which have guarded and guided the conduct of the multiplied activities of the meeting with such unusual success, and in the thought of the many courtesies which have been extended to us on every hand with most genuine hospitality, it is a peculiar pleasure to be called upon to present for adoption by the association the resolution of thanks which are so incomplete an expression of our appreciation of these privileges. At the same time, each one of us must feel that the most extended enumeration would only partially include the many who have so generously contributed to make this meeting a success in every direction.

First of all, the thanks of the association must be extended to the local committee, and particularly to the honorary president, the Hon. David R. Francis; to the chairman, Professor William Trelease; to the secretary, Professor A. S. Langsdorf; to the treasurer, Mr. William H. Thomson, and to the members of the executive committee, Chancellor W. S. Chaplin, Mr. George H. Morgan, Professor F. E. Nipher, Mr. John Schroers, Mr. Walter B. Stevens, Dr. William Taussig and Mr. H. C. Townsend, who, as chairman of the various subcommittees, have arranged for all the details with such forethought as to keep the machinery of a large and complicated program in operation without friction or interference, and to provide for many outside courtesies of the most enjoyable type.

Sincere thanks are due to the Board of Education for placing at our disposal the Central High School building, so admirably adapted to the purposes of this meeting; to Superintendent of Public Instruction F. S. Soldan; to Principal W. J. S. Bryan and his corps of assistants and students for their untiring efforts in caring for the various sections, and to Messrs. George F. Knox, William Butler and S. A. Douglas for their continued oversight and manipulation of the lanterns and other appliances placed at the disposal of the sections.

The association is deeply indebted to the trustees and director of the Missouri Botanical Gardens

for hospitalities extended to members in connection with their visits to this splendid institution, and for the exceptional courtesies tendered in connection with the Shaw banquet.

The association is under obligations to the officers of the Louisiana Purchase Exposition for the luncheon and reception at the grounds of the exposition, and to the chiefs of departments under whose guidance the members were privileged to witness the progress already made toward the completion of this monumental work.

The association must further acknowledge its indebtedness to the press, to the St. Louis Transit Company, to the president of the Board of Public Improvements and to all other organizations, corporations and individuals who have extended so many privileges to members individually and in groups in connection with visiting the great industries and points of interest in St. Louis and vicinity.

The association is under deep obligations to the Mercantile Club, to the University Club, and finally and in especial measure, to the Wednesday Club for the thoughtful hospitalities extended to the ladies registered at the meeting.

It was unanimously voted to extend the thanks of the association to Professor Rutherford for his lecture on radium and radio-activity.

At the meeting of the general committee, held Thursday evening, it was decided to hold the next meeting in Philadelphia, beginning Tuesday, December 27, 1904, and closing Monday, January 2, 1905, it being understood that the Executive Committee of the Council will meet Tuesday, December 27, and the opening session of the meeting will be held Wednesday, December 28. New Orleans was recommended as the place of meeting two years hence.

The following officers were elected for the Philadelphia meeting:

President—W. G. Farlow, Cambridge, Mass.

Vice-Presidents:

Section A—Alexander Ziwet, Ann Arbor, Michigan.

Section B—William F. Magie, Princeton, New Jersey.

Section C—Leonard P. Kinnicutt, Worcester, Massachusetts.

Section D—David S. Jacobus, Hoboken, New Jersey.

Section E—Eugene A. Smith, University, Alabama.

Section F—C. Hart Merriam, Washington, D. C.

Section G—B. L. Robinson, Cambridge, Mass.

Section H—Walter Hough, Washington, D. C.

Section I—Martin A. Knapp, Washington, D. C.

Section K—The present vice-president, Mr. H. P. Bowditch, will serve another year.

General Secretary—Charles S. Howe, Cleveland, Ohio.

Secretary of the Council—Clarence A. Waldo, Lafayette, Indiana.

Charles S. Howe,
General Secretary.

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*THE ELEMENTS: VERIFIED AND UNVERIFIED.**

It is the sad duty of the retiring chairman of this section to chronicle the death of two members. One of them, James Francis Magee, B.S., University of Pennsylvania, 1887, devoted his life chiefly to commercial pursuits, in which he was most successful. He joined the association at the fifty-first meeting, being one of the youngest members. The other was H. Carrington Bolton, Columbia, 1862 (Ph.D. Göttingen, 1865), who, with the exception of four (Gibbs, Boye, Brush and Hilgard), was the senior of the section, having joined at the seventeenth meeting. I beg permission to quote from an article of his in the *American Chemist*, 1876, the year following his elevation to fellowship in the association, as it exemplified in telling words one of the great aims in his life, with the fruitful accomplishment of which you are familiar:

"So rapid are the strides made by science in this progressive age and so boundless is its range, that those who view its career from without find great difficulty in following its diverse and intricate pathways, while those who have secured a foot-

* Address of the vice-president and chairman of Section C, Chemistry, of the American Association for the Advancement of Science, St. Louis meeting, December 28, 1903.

ing within the same road are often quite unable to keep pace with its fleet movements and would fain retire from the unequal contest. It is not surprising, then, that those actually contributing to the advancement of science, pressing eagerly upward and onward, should neglect to look back upon the labors of those who precede them and should sometimes lose sight of the obligations which science owes to forgotten generations.''* His numerous contributions to and intimate knowledge of the history of chemistry, his gentle and generous sympathy aided and stimulated many active in research or technical applications of chemistry. His monumental bibliographies put out by the Smithsonian Institution are masterpieces. The grief and keen regret of his loss are not confined to one nation.

On another occasion it has been the good fortune of him who has the honor of addressing you to-day to indicate that events of literary moment, governmental modifications, inventions and forward stridings in science, have apparently accommodated themselves to historical periods during the past century.† Striking, novel facts and fancies, gleaned in the realm of inorganic chemistry, have crested not a few of the high waves of those human tides that beat against the coasts of the untried and unknown.

The human mind knows by contrasts. For the day we have night; for the good there is evil. Where man would have a God, he also had a devil; for the true there is the false; the verified and unverified. The false may be true through ignorance; the true may be false in the light of new knowledge. Or, as Hegel put it, 'Sein und das nicht Sein sind das Nämliche.'

Is matter continuous or discrete? argued the opposed schools of Grecian philosophy led by Leucippus, Democritus and Epicurus and dominated by Aristotle. Despite the clarity of the statements of the Roman Lucretius,* the atomic hypothesis received scant attention until the seventeenth century of the Christian era, when Galileo's experimental science assailed Aristotelian metaphysics and demanded verification of the premises of that philosophy which had governed all the schools of Europe for two thousand years.† While Gassendi, Boyle, Descartes, Newton, perhaps Boscovich, Lavoisier, Swedeborg, Richter, Fischer and Higgins had to do with our modern atomic theory, Dalton one hundred years ago 'created a working tool of extraordinary power and usefulness' in the laws of definite and multiple proportions. As Clarke‡ remarked, 'Between the atom of Lucretius and the Daltonian atom the kinship is very remote.' Although the lineage is direct, the work of Berzelius, Gmelin and others; the laws of Faraday, Guy Lussac, Avagadro, Dulong and Petit; the reformations of Laurent and Gerhardt, but particularly Cannizzaro; the systematizations of de Chancourtois, Newlands, Hinrichs, Mendelejeff and Lothar Meyer; the stereochemistry of van't Hoff and LeBel have imperialized the ideas of the Manchester philosopher, so that the conceptions of the conservative atomists of to-day are quite different from those at the beginning of the closed century.§

* 'Notes on the Early Literature of Chemistry—The Book of the Balance of Wisdom,' New York Academy of Sciences, May 29, 1876.

† 'The Rare Earth Crusade; What it Portends, Scientifically and Technically,' SCIENCE, N. S., XVII., 722–781.

* "Nature reserving these as seeds of things
Permits in them no minish nor decay;
They can't be fewer and they can't be less."

Again, of compounds—

"Decay of some leaves others free to grow
And thus the sum of things rests unimpaired." Book II., 79.

† See 'The Atomic Theory,' the Wilde Lecture by F. W. Clarke at Dalton Celebration, May, 1903.

‡ *Loc. cit.*

§ While I have examined much of the original literature, Venable's 'History of the Periodic

These have not come about solely through the additive labors of the savants mentioned, for they have been shaped quite as much by speculative and experimental opposition exemplified by Brodie* and Sterry Hunt.†

In Graham's 'Speculative Ideas Respecting the Constitution of Matter'‡ we have the conception that our supposed elements possess 'one and the same ultimate or atomic molecule existing in different conditions of movement. § *Apropos,* we have the suggestion of F. W. Clarke || that the evolution of planets from nebulæ, according to the hypothesis of Kant and Laplace, was accompanied by an evolution of the elements themselves. Even Boyle—'the cautious and doubting Robert Boyle,' as Humboldt said of him—was inclined to the belief that 'all matter is compounded of one primordial substance—merely modifications of the *materia prima.*'

The Daltonian ideas had scarcely reached adolescence before Prout (1815), giving heed to the figures concerned, would have all the elements compounded of hydrogen. The classical atomic mass values obtained by sympathetic Stas and the numerous investigations of those who followed him, with all the refinements human ingenuity has been able to devise, temporarily silenced such speculations, but not until Marignac had halved the unit, Dumas had quartered it, and Zängerle, as late as 1882, insisted upon the one thousandth hydrogen atom.

The notion, like Banquo's ghost, will ever up, for if one may judge from the probability calculations of Mallet* and Strutt,† a profound truth underlies the now crude hypothesis.

Crookes,‡ from observations made during prolonged and painstaking fractionations of certain of the rare earths, supported his previously announced 'provisional hypothesis' as to the genesis of the elements from a hypothetical *protyle,* which existed when the universe was without form and void. He designated those intermediate entities, like yttrium, gadolinium and didymium, 'meta-elements,'§ a species of compound radicals, as it were. *Urstoff,* fire mist, protyle, the ultra-gaseous form, the fourth state of matter || was condensed by a process analogous to cooling; in short, the elements were created. The rate of the cooling and irregular condensation produced 'the atavism of the elements,' and this caused the formation of the natural families of the periodic system. Marignac¶ criticizing this hypothesis, states: "I have always admitted** the impossibility of accounting for the curious relations which are manifested between the atomic weights of the elements, except by the hypothesis by a general method of formation according to definite though unknown laws; even when these relations have the character of general and absolute laws."

Further, "I do not the less acknowledge

Law' has been most helpful. I have, furthermore, had the privilege of reading very carefully the manuscript of a work entitled 'The Study of the Atom' (in press), by Dr. Venable.

* 'Calculus of Chemical Operations,' *J. Chem. Soc.*, 21, 367 (1866), and his book, 'Ideal Chemistry,' 1880.

† Numerous papers summarized in 'A New Basis for Chemistry.' New York, 1887 and 1892 (fourth edition).

‡ *Proc. Roy. Soc.*, 1863.

§ Venable, 'The Definition of the Element,' vice-presidential address, Section C, American Association for the Advancement of Science, Columbus meeting, 1899.

|| 'Evolution and the Spectroscope,' *Pop. Sc. M. Jour.*, 1873.

* *Phil. Trans.*, 171, 1003, 1881.

† *Phil. Mag.* (6), 1, 311.

‡ *Chem. News*, 55, 83, 1886.

§ Address before Chemical Section of the British Association, *Chem. News*, 54, 117, 1885.

|| Crookes, Royal Societies, June 10, 1880.

¶ *Archives des Sciences Physiques et Naturelles*, 17–5; *Chemical News*, 56, 39.

**Remarks made in 1860–5 after publication of Stas's 'Researches on Atomic Weights,' Archives, 9, 102, 24–376.

that the effect of constant association of these elements is one of the strongest proofs that can be found of the community of their origin. Besides, it is not an isolated fact; we can find other examples such as the habitual association in minerals of tantalum, niobium and titanium.''

Sir John Herschel thought that all the atoms were alike and the elements, as we know them, 'have the stamp of the manufactured article.'

Hartley* this year says: 'It is more than twenty years since the study of homology in spectra led me to the conviction that the chemical atoms are not the ultimate particles of matter, and that they have a complex constitution.'

The peculiar discharge from the negative electrodes of a vacuum tube was investigated many years ago by Hittorf and Crookes, who arrived at the conclusion that it was composed of streams of charged particles. All are familiar with the very recent proposed 'electrons' and 'corpuscles' resulting from the beautiful physical researches of Lodge and J. J. Thomson. These appear to have caused a trembling in the belief of many in the immutability of the atom, and the complete abandonment of the atom is seriously discussed by others.

''If the electrons of all elements are exactly alike, or, in other words, if there is but one matter, just as there is but one force, and if the elements be but the various manifestations of that one matter, due to a different orbital arrangement of the electrons, it would seem that we are fast returning to the conceptions of the middle-aged alchemist. The transmutation of metals involves but the modification of the arrangement of the electrons.'' Such efforts as Fittica's* should not be treated with scorn, but given careful examination and merited consideration, as Winkler† gave his. Science should thus ever be 'a foe of raw haste, half-sister to delay.'‡

Although by chemical means, so far, we have been unable to break up the atoms, apparently electrical energy, in the form of cathode rays, for example, follows the grain of atomic structure. Some advanced thinkers look upon the atoms as disembodied charges of electricity. Ostwald has taught it. Electric charges are known only as united to matter, yet Johnstone, Stoney and Larmor have speculated on the properties of such charges isolated. ''Such a charge is inertia, even though attached to no matter, and the increase of inertia of a body due to electrification has been calculated by both Thomson and Oliver Heaviside, the conception accordingly being advanced that all inertia is electrical and that matter, as we know it, is built up of interlocked positive and negative electrons. If it were possible in any mass of matter to separate these electrons then matter would disappear and there would remain merely two enormous charges of electricity.'' We are aware of phenomena attributed to the negative electrons; we await anxiously the announcement of the positive electrons. But here the water is deep and one may not swim too well.

We do know, however, as A. A. Noyes says,§ that 'there exists in the universe some thing or things other than matter which, by association with it, give rise to the changes in properties which bodies exhibit, and give them power of producing changes in the properties of other bodies.'

* Address before the Chemical Section, British Association, Southport meeting, September, 1903, *Chem. News*, 88, 154.

* 'Black Phosphorus, or Conversion of Phosphorus into Arsenic,' *Chem. News*, 81, 257; 82, 166.

† *Berichte*, 33, 10; *Chem. News*, 81, 305.

‡ Van Dyke in 'The Ruling Passion.'

§ 'General Principles of Physical Science,' p. 13, 1902.

Further (p. 15), "* * * matter is that which gives rise to the localization of the complex of properties which certain portions of space exhibit. Even though, on the one hand, it must be admitted that the existence of matter is inferred only from various energy manifestations which bodies exhibit, it must be acknowledged, on the other, that there are no manifestations of energy except those which are associated with the manifestations of it that have led to the adoption of the concept of matter; in a word, the two assumed entities, matter and energy, are indissolubly connected in our experience." Thus, as Dumas said, 'Hypotheses are the crutches of science to be thrown away at the proper time.'

I have dared to sketch these conceptions in a few bold outlines, for

> "We can't enumerate them all!
> In every land and age have they
> With honest zeal been toiling on,*
> To turn our darkness into day."

The imposition upon your good nature practiced in the foregoing craves its pardon in an effort to seek a definition for the term, element. Shall we say, as does Remsen, 'An element is a substance made up of atoms of the same kind?' Can we say that it is not? Venable† truly says: 'An element is best defined by means of its properties.' These conceits are not exclusive. The properties are the result of the action of physical forces and chemical affinity, whatever that may be. Certain of the novel atmospheric gases have so far responded but poorly to the latter, as predicted before their discovery by Flawitzsky, Julius Thomsen and de Boisbaudran in 1887. This necessitates, according to Piccini‡ our dividing them at once into two classes.

* Aikens' poem at Priestley centennial, *Am. Chemist*, 1875, 23.

† The 'Definition of the Element,' *loc. cit.*

‡ *Zeit. Anorg. Chem.*, 19, 295, 1899.

Pattison Muir gives a satisfactory definition.* "The notion of the elements that has been attained after long, continued labor is that of certain distinct kinds of matter, each of which has properties that distinguish it from every other kind of matter, no one of which has been separated into portions unlike the original substance, and which combine together to produce new kinds of matter that are called compounds." The following simpler definition has finally served as my guide: *An element is that which has not been decomposed, so far as we are aware, into anything other than itself.* In short, it is consistent.

It is well to stop occasionally and take stock. The Daltonian centenary could not but be an opportune time. Stable, certified securities are not enumerated in the list which follows. Having in mind the second chapter of the first book of Chronicles, certain so-called elements are mentioned, for yttrium begat cerium, and cerium begat lanthanum, and lanthanum begat samarium and didymium, and didymium begat neodidymium and præseodidymium, and præseodidymium begat α- and β-præseodidymium, *'und so weiter.'*

Unpractised as a reading clerk, I shall spare you the strain of hearing this long list of elements on probation, but submit for leisure perusal printed copies which will form an appendix to the address as published in the *Proceedings* of the association.

From the table have been omitted urstoff, protyle (Crookes), electrons (Lodge), corpuscles (J. J. Thomson) and pantogen (Hinrichs). It appeared also unnecessary to incorporate phlogiston, nitricum (the imaginary body, thought by Berzelius united with oxygen to form nitrogen), and arœon (ponderable caloric). According to

* 'The Alchemical Essence and the Chemical Element,' London, 8vo, pp. 94, 1894.

Meissner, hydrochloric acid is composed of two equivalents of oxygen, one of water, combined with aræon and the imaginary radical murium (*vide* Bolton). Often alloys have been prepared and given names like the elements, 'magnalium,' for example. These are omitted also. Otherwise, I have purposely included every suggestion of an element I could obtain. The summary, while doubtless deficient, may secure an historical vindication.

What shall we do with these numerous aspirants whose recognition is urged? "These elements perplex us in our researches, baffle us in our speculations and haunt us in our very dreams. They stretch like an unknown sea before us, mocking, mystifying and murmuring strange revelations and possibilities," said Crookes, referring to the rare earths. Some have been verified, many unverified; some are true, some are false. Without doubt some have been presented without sufficient stage setting, yet the good faith of many can not be questioned. In fact, from this list, as one reads, he perceives the whole gamut of scientific emotions. There he may find the tragedies of elemental pretension, the comedies, yea, the very farces.

We need not look far to ascertain explanations for certain incorrect conclusions. The extreme rarity of the minerals in which many of the tentative elements have been detected, the excessively small percentages of the new ingredients, and the extraordinary difficulties attending their separation from known and unknown substances combine to render the investigations laborious, protracted and costly. De Boisbaudran required 2,400 kilograms of zinc blend for 62 grams of gallium. Ramsay* has shown one part of crypton in twenty million volumes of air, while a like amount of xenon requires one hundred and seventy million. How patiently and persistently that modest Parisian couple followed Becquerel's rays!

Furthermore, when one feels that he has obtained something novel, the absolute proof is fraught with difficulties and uncertainties. We have decided to define an element by its properties. The alterations produced in the properties of the most characteristic elements by the presence of small amounts of foreign substances are evident in steel. The influence of arsenic upon the conductivity of copper is well known, and Le Bon* has recently shown that traces of magnesium (one part in 14,000) in mercury cause the latter to decompose water and to oxidize rapidly in the air at ordinary temperatures. Thorium with less than a trace of actinium produces an auto-photograph.

This point can not be too strongly stressed in the rare earth field. One who has wrought with thorium dioxide well knows the influence a small amount of cerium has upon its solubility. The conflicting statements in the literature as to the colors of the oxides of the complexes, neodidymium and præseodidymium, cause one to wonder if different researchers have had the same hæcceity.

An appeal to the spectroscope is of course in the minds of all my hearers.

It was once supposed that each element has its characteristic spectrum which remained the same under all circumstances. Keeler† calls attention to modern investigations which have shown that the same element can have entirely different spectra. For example, oxygen may be caused to have five different spectra; nitrogen, two, etc. In fact, there is no indication in the appearance of the spectra that they belong to the same substance; yet through the result of the work of Rydberg, Kayser, Runge and

* *Zeit. phys. Chem.*, 44, 74, 1903.

* *Compt. rend.*, 131, 706, 1900.

† *Scientific American Supplement* 88, 977, 1894, and *Popular Astronomy*.

Precht, series of groups of lines are had which satisfy mathematical formulæ.

"It was proposed by de Gramont, at the International Congress in Paris, in 1900, and agreed, that no new substance should be described as an element until its spark spectrum had been measured and shown to be different from that of every other known form of matter." As Hartley * remarks, 'This appears to me to have been one of the most important transactions of the congress.' Radium † was the first to be tested by this rule. Exner and Haschek obtained 1,193 spark and 257 arc lines for Demarcay's europium. It must not be forgotten, however, that by overlapping, lines in mixtures may be masked or appear, which are absent, in those bodies of the highest state of purity. It must not be forgotten that pressure influences the spectrum, usually producing a broadening of the lines, as shown by Schuster, and that it may occur symmetrically or only towards the least refrangible red. Lest we forget, the spectroscope failed a long time to show radium and we knew it was there. It must not be forgotten, as Krüss§ has shown, that the 'influence of temperature can not be neglected and ignored, but must be considered by every chemist who wishes to make correct spectroscopic observations.' It is well known to spectroscopists that band spectra are obtained at temperatures intermediate between those required for the production of continuous spectra and line spectra.‖

The explanations of these facts do not concern us at present.

It has been shown by the researches of Newton, Dale, Gladstone, Jamin, Schrauff, Landolt and others that the refractive power increases in all liquids, except in water, between 0° and 4° with the increase of density—that is, with decrease of temperature. Rydberg showed that various solid bodies, such as quartz and aragonite, follow the same law. There are some exceptions, however. Among these is glass, as proved by Arago and Neumann prior to Rydberg. "On a rise of temperature all phenomena of absorption or emission are displaced toward the violet with the glass prisms, but toward the red with quartz prisms. These displacements are the greater the more refrangible the region of the spectrum in which they occur." As the result of a large number of observations, Krüss learned that by a variation of 25°, marked changes would be observed in the spectroscopic lines. From a table given, it could be seen that errors may spring from neglect of the temperature (of the instrument?) in stating wave-lengths, since a rise of 5° is sufficient to transfer the D_1 to the position D_2. Roscoe obtained an entirely new spectrum with the metal sodium, whereby it appears that this metal exists in a gaseous state in four different degrees of aggregation, as a simple molecule, and as three or four or eight molecules together.

Grünwald in a series of papers on his theory of spectrum analysis* endeavors "to discover relations between the spectra and thus to arrive at simpler, if not fundamental 'elements.'" He came to the conclusion that 'all the so-called elements are compounds of the primary elements *a* and

* Address before the Chemical Section of the British Association, Southport, 1903.

† Runge and Precht, *Am. Physik.*, IV., 12, 407, 1903.

‡ British Association, *Report*, 1880, 275. *Vide* also Lockyer and Frankland, *Proc. Roy. Soc.*, 27, 288, 1869.

§ 'The Influence of Temperature upon the Spectrum; Analytical Observations and Measurements,' *Liebig's Annalen*, 238, 57; *Chem. News*, 56, 51.

‖ 'Spectrum Analysis,' Landauer, English translation by Tingle, p. 70.

* 'Uber das Wasserspectrum, das Hydrogen— und Oxygenspectrum,' *Phil. Mag.*, 24, 304, 1887. 'Math. Spectralanalyse des Magnesiums und der Kohle,' *Monatshefte für Chemie*, 8, 650. 'Math. Spectralanalyse des Kadmiums,' *Monatshefte für Chemie*, 9, 956.

b' (coronium and helium). Ames,* having called attention to the use of uncorrected data by Grünwald, remarks: 'The concave grating gives the only accurate method of determining the ultra-violet wave-lengths of the elements; and as a consequence of not using it, most of the tables of wave-lengths so far published are not of much value.'

Hutchins and Holden,† after a comparative study of the arc spectra of metals and the sun with a twenty-one-foot focal Rowland grating, state: "We are convinced that there is much in the whole matter of coincidences of metallic and solar lines that needs reexamination; that something more than the mere coincidence of two or three lines out of many is necessary to establish even the probability of the presence of a metal in the sun. With the best instruments the violet portion of the solar spectrum is found to be so thickly set with fine lines that, if a metallic line were projected upon it at random, in many places the chances for a coincidence would be even, and coincidences could not fail to occur in case of such metals as cerium and vanadium, which give hundreds of lines in the arc."

"Moreover, a high dispersion shows that very few lines of metals are simple and short, but, on the contrary, winged and nebulous, and complicated by a great variety of reversal phenomena. A 'line' is sometimes half an inch wide on the photographic plate, or it may be split into ten by reversals."

Lockyer maintained that the lines of certain brilliant substances vary not only in length and in number, but also in brilliancy and in breadth, depending upon the quantity of the substance as well as temperature.* Being unable to decompose the elements in the laboratory, he studied the spectra of the stars. The spectra of the colder stars† show many more metals, but no metalloids, whereas the coldest stars, *A. Orionis,* show the Crookes spectrum of metalloids which are compounds. None of the metalloids are found in the spectrum of the sun. Over 100,000 visual observations and 2,000 photographs were made in the researches.

Liveing,‡ as the result of the work of Young, Dewar, Fievez and himself on the spectrum of the sun, by which some lines were resolved with a new instrument, which they before had not been able to devise, comments on Lockyer's work: That the coincidence of rays emitted by different chemical elements, especially when developed in the spark of a powerful induction coil, and the high temperature of the sun and stars, gives evidence of a common element in the composition of the metals which produce the coincident rays. "This result can not fail to shake our belief, if we had any, in the existence of any common constituent in the chemical elements, but it does not touch the evidence which the spectroscope affords us that many of our elements, in the state in which we know them, may have a very complex molecular structure."

Hartley§ in his recent admirable address said:

"I have always experienced great difficulty in accepting the view that because the spectrum of an element contained a line or lines in it which were coincident with a line or lines in another element, it was evidence of the dissociation of the elements into simpler forms of matter. In my opinion, evidence of the compound nature of the

* *Am. Chem. J.*, 11, 138, 1889.

† 'On the Existence of Certain Elements, Together with the Discovery of Platinum, in the Sun,' *Am. Jour. Sci.; Sci. Am. Supp.*, 25, 628, 1888.

* *Roy. Soc. Proc.*, 61, 148, 183; *Chem. News*, 79, 145.

† *Chem. News*, 79, 147.

‡ Address before the Chemical Section of the British Association, *Scientific American Supplement*, 14, 356, 1882.

§ *Loc. cit.*

elements has never been obtained from the coincidence of a line or lines exclusively belonging to the spectrum of one element with a line or lines in the spectrum exclusively belonging to another element. This view is based upon the following grounds: (1) Because the coincidences have generally been shown to be only apparent, and have never been proved to be real; (2) because the great difficulty of obtaining one kind of matter entirely free from every other kind of matter is so great that where coincident lines occur in the spectra of what have been believed to be elementary substances, they have been shown from time to time to be caused by traces of foreign matter, such as by chemists are commonly termed impurities; (3) no instance has ever been recorded of any homologous group of lines belonging to one element occurring in the spectrum of another, except and alone where the one has been shown to constitute an impurity in the other; as, for instance, where the triplet of zinc is found in cadmium and the triplet of cadmium in zinc the three strongest lines in the quintuple group of magnesium is graphite, and so on. The latest elucidation of the cause of coincidences of this kind arises out of a tabulated record from the wave-length measurements of about three thousand lines in the spectra of sixteen elements made by Adeney and myself. The instances where lines appeared to coincide were extremely rare; but there was one remarkable case of a group of lines in the spectrum of copper which appeared to be common to tellurium; also lines in indium, tin, antimony and bismuth which seemed to have an origin in common with those of tellurium."

The last sentence presents the point I wish to emphasize. Tellurium has long obtruded itself before a satisfactory vision of the natural system. The table alone recites not a few efforts to obtain the contaminating constituent of tellurium which *a priori* is present from Hartley's observations (see also Grünwald 1889 table). The fractionation of a rubidium-cæsium mixture, perhaps, is a simpler problem than that confronting Pellini,* who reports a definite amount of an element with a high atomic weight (about 214), similar to and associated with tellurium.

* *Gaz. Chim. ital.*, 33, 11, 35.

What has been said applies especially to the elements of the rare earth class —'asteroids of the terrestrial family'—as phrased by Crookes. Many of them have not been secured with sufficient purity to claim an inherent spectrum; further, the spectra attributed have not been obtained under uniform conditions.

I have referred* somewhat in detail elsewhere to the factors producing variations in the absorption, as well as the advantages and disadvantages of the phosphorescent and reversal, spectra.

Without doubt the spectroscopic criteria are the most valuable we have in judging finally the elements, and mayhap will remain so, but in my humble opinion, such have not alone sufficient authority, as yet, to usher the aspirant to a place among the elect. The contention frames itself, however, in an expression of the need for uniformity.

Whether we follow the most advanced metaphysico-chemical teachings or no, if there be any one concept upon which modern practical chemical thought depends, it is the law of definiteness of composition. There may be, and doubtless are, definite, perhaps invariable, properties of our elements other than their combining proportions, the atomic weights, if you please, yet, as far as we know, they approximate more closely than any fixed, if not permanent, ratios. Many of these values, by which we lay such store, are dependent upon data† in which, I venture the assertion, too great confidence has been bestowed, or opinions to which sufficient attention has not been given.

Although in this connection we shall give little heed to the suggested variability of the relative values, it may be remarked that Boutlerow, noting the variations ob-

* 'The Rare Earth Crusade,' *loc. cit.*

† Others have been referred to in the address to which this is a sequel. *Loc. cit.*

served in 1880 by Schützenberger, who, by the use of different atomic weights, obtained analyses summing 101 instead of 100, expressed the opinion that the chemical value of a constant weight, or rather mass of an element, may vary; that the so-called atomic weight of an element may be simply the carrier of a certain amount of chemical energy which is variable within narrow limits. (See also Crookes.) Wurtz's summary of Boutlerow's views, at a meeting of the Chemical Society of Paris, provoked an interesting discussion. Cocke later published a statement that he had expressed similar views more than twenty-five years before. That is, in 1855, he had questioned the absolute character of the law of definite proportions and had suggested that the variability was occasioned by the very weak affinity between elements manifesting a fluctuating composition. Without doubt 'The Possible Significance of Changing Atomic Volume,'* in which a suggestion as to the probable source of the heat of chemical combination is put forward by T. W. Richards, bears directly upon this phase of the problem.

While the atomic mass values depend directly upon the ratio between the constituents of the compounds, they rest equally upon the molecular weights. Many of the latter attributed to salts of some of the rare earths depend solely upon the specific† heat determinations of Hillebrand and Norton,‡ Nilson and Pettersson,§ who, in the light of subsequent investigations, we know, worked with complexes. To be sure, those elements which were apparently exceptions to the law of Dulong and Petit, possess low atomic weights (beryllium, boron, carbon, silicon, aluminum and sulphur) and have for the most part been brought into harmony. "The specific heats of all substances vary with the temperature at which they are measured; and though the variation is often slight, it is occasionally of relatively great dimensions. When this is so in the case of an element, the question arises: At what temperature must the measurement of the specific heat be made in order to get numbers comparable with those of the other elements? No definite answer has been given to this question, but it is found that as the temperature rises, the specific heat seems to approach a limiting value, and this value is not in general far removed from that which would make the atomic heat approximately equal 6.4."* In view of this, allotropism, and the work of Richards adverted to, it appears that a revision of the specific heat values now taken is necessary before we can accept fully this law, which has been most helpful.

Time will not admit of detailed statements, and it is unnecessary in this presence to more than call attention to the fact that what has been said is not applicable to each specific case. *'La critique est facile, mais l'art est difficile,'* as Berthelot† has said, yet we must appreciate that all our laws have their limitations. "Man being servant and interpreter of nature, can do and understand so much and so much only, as he has observed in fact or in thought in the course of nature. Beyond this he neither knows anything nor can do anything."‡

A glance at the extensive, even censored, list of claimants will evoke serious thought. "Thus was the building left ridiculous."§ The difficulties briefly outlined and the causes for lack in uniformity are by no means insurmountable, but will continue

* *Proc. Am. Acad. Arts and Sciences*, 27, 1, 1901, and 27, 399, 1902.

† *Berichte*, 13, 1461, 1880.

‡ *Pogg. Annal.*, 156 and following.

§ *Berichte*, 13, 146, 1880.

* 'Introduction to Physical Chemistry,' James Walker, London, p. 33.

† 'Les Origines de l'Alchimie,' Paris, 1885.

‡ Bacon's 'Novum Organum,' Aphorism I.

§ Milton, 'Tower of Babel.'

until more systematic direction and prosecution of the work come about. Investigators in pure chemistry as a rule hold professorships, or other positions making equal demand upon their time. Furthermore, it is extremely rare that one man can become a master of the various delicate operations hinted at. Mallet* made a proposition for systematizing atomic weight work and F. W. Clarke in this country† and abroad‡ has urged the establishment of an institute for its prosecution. This appeals to all interested in what we are pleased to term the exact sciences, and doubtless in time will come about. For the time being, however, it is not unreasonable to suppose that a concerted appeal of the chemists of this country to the direction of the munificent endowment recently made American science for funds to clarify the elemental enigma presented above would not be in vain. There are splendidly equipped chemical departments in some of our great American universities which would make room for, and cordially welcome, I am sure, a selected corps of supported researchers, who would test the claims of each of these and other elemental aspirants. Such a community of effort should receive even greater substantial assistance from governments and corporations than has been accorded individuals. I need only refer to the aid given the Curies by the Austrian government, and generosity shown by the Welsbach Lighting Company in this country to several investigators, especially myself.

It must be evident to all that we are not indulging in special pleading, for every phase of that division of science designated chemistry rests upon what we choose to term the elements.

Victor Meyer,* referring to the phantasies of science, said: "He, however, who only knows chemistry as a tradition of perfectly clear facts, or who thinks to see the real soul of chemical study in measuring physical phenomena which accompany chemical transformations, feels no breath of this enjoyment." Reflecting upon the good and ill that have come to us through unrestrained imagination, we may give a careful acceptance of Newton's 'Physics, beware of metaphysics' for as Clifford wrote, 'Doubtless there shall by and by be laws as far transcending those we know as they do the simplest observations.'

The graphic representation of the elements, 'the foundation stones of the material universe which amid the wreck of composite matter remained unbroken and unworn,' as Maxwell gracefully spoke of them, has often been mistaken for the periodic law. Carnelley's 'reasonable explanations' of the periodic law were given a respectful hearing and forgotten.†

"Granting that the chemical characteristics of an element are connected with its atomic weight, we have, however, no right to assume them to be dependent upon that fact alone" (Liveing). Hinrichs says weight and form,‡ concerning the latter of which I am ignorant. No doubt the pendulum lately has swung back toward Berzelian thought revivified by the like masters, van't Hoff and Arrhenius.

Le Verier predicted the planet Neptune

* Stas memorial lecture, Chemical Society (London), delivered December 13, 1892.

† Presidential address before the American Chemical Society.

‡ Wilde lecture at the Dalton Centenary, Manchester, 1903.

* Lecture on 'The Chemical Problems of To-day' before the Association of German Naturalists and Physicians at Heidelberg, September, 1889; *Chemical News*, 61, 21.

† He regarded the elements as compounds of carbon and ether analogous to the hydrocarbon radicals, and suggested that all known bodies are made up of three primary elements—carbon, hydrogen and ether—truly an assumption which can not be disproved. Aberdeen meeting, British Association.

‡ 'Atom Mechanics,' Hinrichs, Vol. I., St. Louis, 1894, p. 242.

and his predictions were verified. While all of Mendelejeff's predictions, specific and tacit, have not been verified, some have. Ramsay* and others, without a periodic guide, predicted certain of the inert gases, which predictions have been verified.

Victor Meyer, in speaking of the completion of the Mendelejeff table, calls attention to the summing up of one hundred elements, from which it appears that 258 would be the limit to our atomic mass equivalents. I am not prepared positively to contradict such a conclusion at the present time, but there are reasons for thinking otherwise.

Clarke† has shown that the mean density of the earth, 5.5 to 5.6, is more than double that of the rocky crust, and 'the difference may be accounted for as a result of pressure, or by supposing that, as the globe cooled, the heavier elements accumulated towards the center.' While it is quite impossible to judge of the order of this intramundane pressure, I am not aware of such marked changes being brought about in the specific gravities of the heavier solid elements of their compounds, either by pressure, allotropic or isomeric changes, except the cerebral argentaurum of the late S. H. Emmens.‡ The examinations of volcanic dusts by Hartley,§ Fleet|| and others appear to contradict the latter explanation, although we are unable to state the depth, perhaps within the shell considered by Clarke, at which volcanoes begin their boisterous activity. While awaiting a fulfillment of Martinez's* project to explore the earth's center, we may offer a third solution, not wholly unscientific, as it can do no harm, and has nought to do with any yellow peril in science, namely, the existence of elements with atomic weights higher than those set by the silent limit of periodic tables.

"Most molecules—probably all—are wrecked by intense heat, or, in other words, by intense vibratory motion, and many are wrecked by a very impure heat of the proper quality. Indeed, a weak force, which bears a considerable relation to the construction of the molecule, can by timely savings and accumulation accomplish what a strong force out of relation fails to achieve."†

As hinted at in the earlier portion of this unduly prolonged address, many have theorized as to the ultimate composition of matter. The logic of Larmor's‡ theory, involving the idea of an ionic substratum of matter, the support of J. J. Thomson's§§ experiments, the confirmation of Zeeman's phenomenon, the emanations of Rutherford, Martin's|| explanations, can not fail to cause credence in the correctness of Crookes's idea of a fourth state of matter.¶ In the inaugural address as president of the British Association (1898), he acknowledges in the mechanical construction of the Roentgen ray tubes a suggestion by Silvanus Thompson to use for the anticathode a metal of high atomic weight. Osmium and iridium were used, thorium tried, and in 1896 Crookes obtained better results with metallic uranium than platinum.

These and the facts that most of the elements with high atomic weights, in fact

* Address before the Chemical Section, British Association, Toronto meeting (1898).

† 'The Relative Abundance of the Chemical Elements,' F. W. Clarke, read before the Philosophical Society of Washington, October 26, 1899; *Chem. News*, 62, 31.

‡ Argentaurum papers published by Emmens, New York.

§ Royal Society, February 21, 1901; *Chem. News*, 83, 174.

|| Abstr. *Proc. Geol. Soc.*, 1902, 117; *Journ. Chem. Soc.* (Land), 81–82, ii., 518, 1902.

* 'La Nature,' *Sc. Am. Sup.*, 21, 546, 1886.

† Tyndall in *Longman's Magazine*.

‡ *Phil. Mag.*, December, 1897, 506.

§ *Phil. Mag.*, October, 1897, 312.

|| *Chem. News*, 85, 205, 1902.

¶ *Phil. Trans.*, II., 1881, 433.

all above 200 (thallium not reported on),* exhibit radio-active properties, are doubtless closely associated and have to do with the eventual composition of matter. I have unverified observations which go to show the existence of at least one element with a very high atomic weight. If it be confirmed, then we have them now or they are making, and probably breaking up, as shown by that marvelous class of elements in the discovery of which the Curies have been pioneers.

If our ideas that all known elements come from some primordial material be true, then it stands to reason that we are coming in time, perhaps, to that fixed thing, a frozen ether, the fifth state of matter. I may make use of dangerous analogy and liken our known elements, arranged in a perfected natural system, to the visible material spectrum, while electrons, etc., constitute the ultra-violet and *cosmyle* composes the infra-red, either one of the latter by proper conditions being convertible into perceptible elemental matter. No positive evidence supports these ideas, but I like to fancy scientific endeavor as the sea—calm and serene, supporting and mirroring that which is below it, bearing that which is upon it, reaching to and reflecting that which is above it, moving all the while; yet, torn and rent at times by conflict from without and contest within, it runs; it beats against the shores of the unknown, making rapid progress here, meeting stubborn resistance there, compassing it, to destroy but to rebuild elsewhere; and the existence of those within it! 'Like that of Paul, our life should be a consecrated unrest.'

Charles Baskerville.

* See the exquisite paper by Madame Curie on 'Radioactive Substances,' also 'Radio-active Lead,' Hofmann and Strauss, *Berichte*, 34, 3033, Pellini (*loc. cit.*) on 'Radio-active Tellurium'; Strutt, *Phil. Mag.*, 6, 113, Elster and Geitel, Giesel, Marckwald, etc., etc.

MEETINGS OF AFFILIATED SCIENTIFIC SOCIETIES AT PHILADELPHIA.

The Association of American Anatomists, the Society of American Bacteriologists, the Society for Plant Morphology and Physiology, the American Physiological Society, the American Society of Zoologists (Eastern Branch), the American Society of Vertebrate Paleontologists, met in Philadelphia, Pa., December 28–31, 1903. All of these societies except the last, which was organized only one year ago, have heretofore been affiliated with the American Society of Naturalists, and, with the exception of the annual discussion and dinner which the Society of Naturalists holds, the meetings this year were wholly similar to those which have been held by these societies during the past ten or twelve years.

On Monday evening there were informal meetings of the members of the various societies. The Society for Plant Morphology and Physiology was given a reception at Biological Hall, University of Pennsylvania; the American Physiological Society held a smoker at the Hotel Walton, while the other societies held smokers at the 'Rathskellar.'

Tuesday morning and afternoon, sessions of all the societies were held at the University of Pennsylvania, and all the societies except the physiologists held morning and afternoon sessions there on Wednesday also. The Physiological Society met on Wednesday at Jefferson Medical College. Luncheon was served by the University of Pennsylvania to all the societies on Tuesday and to all except the physiologists on Wednesday; on this day the latter society was entertained at luncheon at the Philadelphia Club.

Tuesday evening all the societies were the guests of the local committee at a smoker at the University Club.

Wednesday evening a lecture was given

before the members of the various societies at the Academy of Natural Sciences by Professor W. B. Scott, on 'The Miocene Fauna of Patagonia and the Problem of the Southern Hemisphere.' After the lecture a brilliant and most enjoyable reception was given to the members of the societies by Dr. and Mrs. Horace Jayne.

About two hundred members of the various societies attended the meetings, and the papers presented were numerous and, in some of the societies at least, more than usually interesting.

The following officers were elected for the ensuing year:

Association of American Anatomists: President, Professor Charles S. Minot, of Harvard University; *First Vice-President*, Professor George A. Piersol, of the University of Pennsylvania; *Second Vice-President*, Professor J. M. Flint, of the University of California; *Secretary and Treasurer*, Dr. G. Carl Huber, of the University of Michigan; *Executive Committee*, Dr. Franklin P. Mall, Dr. George S. Huntington.

Society of American Bacteriologists: President, Dr. F. G. Novy, of the University of Michigan; *Vice-President*, Dr. E. O. Jordan, of the University of Chicago; *Secretary and Treasurer*, Dr. F. P. Gorham, of Brown University. Dr. William H. Welch was elected a delegate to the Council of the American Association for the Advancement of Science.

Society for Plant Morphology and Physiology: President, Dr. G. T. Moore; *Vice-President*, Professor Clara E. Cummings; *Secretary and Treasurer*, Professor W. F. Ganong.

American Physiological Society: President, Professor Russell H. Chittenden, of Yale University; *Secretary and Treasurer*, Professor Frederic S. Lee, of Columbia University; *Members of Council*, Professor William H. Howell, of Johns Hopkins University; Professor Warren P. Lombard, of the University of Michigan; Professor William T. Porter, of Harvard University; Professor Frederic S. Lee, of Columbia University.

American Society of Zoologists, Eastern Branch: President, Professor E. A. Andrews, of Johns Hopkins University; *Vice-President*, Professor W. E. Castle, of Harvard University; *Secretary and Treasurer*, G. A. Drew, of the University of Maine; *Executive Committee*, Professor H. S. Jennings, of the University of Pennsylvania; T. H. Montgomery, Jr., of the University of Texas; H. C. Bumpus, of the American Museum of Natural History.

American Society of Vertebrate Paleontologists: President, Professor Henry F. Osborn, of Columbia University and the American Museum of Natural History; *Secretary*, Dr. O. P. Hay, American Museum of Natural History; *Executive Council*, Professor Bashford Dean, of Columbia University; Professor Loomis, of Amherst College; Dr. C. R. Eastman, of Harvard University.

AMERICAN MATHEMATICAL SOCIETY.

THREE meetings of the American Mathematical Society were held during the Christmas holidays. On December 19 the San Francisco Section met at the University of California; the annual meeting of the society was held at Columbia University, December 28–29; and the winter meeting of the Chicago Section was held at St. Louis, in connection with that of the American Association for the Advancement of Science December 31 to January 1.

Reports of the sectional meetings will appear in a later number of SCIENCE. At the annual meeting in New York officers for the society for 1904 and members of the council to serve for three years were elected as follows:

Vice-Presidents—Oskar Bolza and J. M. Van Vleck.

Secretary—F. N. Cole.

Treasurer—W. S. Dennett.

Librarian—D. E. Smith.

Committee of Publication.—F. N. Cole, Alexander Ziwet, D. E. Smith.

Members of the Council—Maxime Bôcher, Florian Cajori, M. B. Porter, J. H. Tanner.

The president of the society, Thomas S. Fiske, continues in office, the presidential term being two years.

The following persons were elected to membership in the society: R. F. Deimel, Columbia University; C. S. Forbes, Columbia University; O. T. Geckeler, Georgia School of Technology; E. A. Hook, Columbia University; L. A. Martin, Jr.,

Stevens Institute of Technology; Miss Virginia Ragsdale, New York City; S. E. Rasor, Ohio State University; A. E. Young, Purdue University; J. E. Wright, Bryn Mawr College. Six applications for membership were received.

Annual reports were received from the treasurer, librarian and secretary. The society continues to hold its own financially. It could accomplish more if larger funds were at its disposal. The library has increased to over 1,300 volumes, and now receives by exchange with the *Bulletin* and *Transactions* the current volumes of nearly every mathematical journal in the world. The membership of the society is now 455, a gain of 54 during the past year. The 'Annual Register' will be issued about the middle of January.

Committees were appointed to arrange for the publication of the course of lectures delivered at the Boston colloquium, September, 1903, and to consider the question of the future financial support of the *Transactions*, which has hitherto been published by the aid of subventions terminating in 1904.

The following papers were read at the annual meeting:

E. V. HUNTINGTON: 'A set of independent postulates for the algebra of logic (second paper).'

J. G. HUN: 'On certain invariants of two triangles.'

O. D. KELLOGG: 'Note on Cauchy's integral.'

J. I. HUTCHINSON: 'On certain automorphic functions.'

W. F. OSGOOD: 'On a gap in the usual presentation of Weierstrass's theory of functions.'

E. V. HUNTINGTON: 'Third complete set of postulates for the theory of positive integers.'

E. V. HUNTINGTON: 'Second complete set of postulates for the theory of magnitudes or positive real quantities.'

W. B. FITE: 'On some properties of groups whose orders are powers of a prime.'

E. J. WILCZYNSKI: 'On ruled surfaces whose flecnode curve intersects every generator in two coincident points.'

VIRGIL SNYDER: 'Complete enumeration of sextic scrolls having a rectilinear directrix.'

F. MORLEY: 'On the triplicity of 3-points in a plane.'

C. L. E. MOORE: 'Classification of surfaces of singularities in the quadratic spherical complex.'

L. D. AMES: 'On the theorem of analysis situs relating to the division of the plane or of space by a closed curve or surface.'

W. B. FORD: 'On the function defined by a Maclaurin series.'

P. F. SMITH: 'Linear transformations of a quadratic form into itself.'

E. B. WILSON: 'Projective and metrical geometry.'

C. H. SISAM: 'On the depiction of the lines of a special linear complex on the points of space.'

EDWARD KASNER: 'Investigations on isothermal systems.'

About fifty persons attended the meeting. On Monday evening an informal dinner contributed to the pleasures of the occasion.

The next meeting of the society will be held at Columbia University on February 27. The Chicago Section will meet again in April and the San Francisco Section in May.

F. N. COLE,
Secretary.

SCIENTIFIC BOOKS.

The General Principles of Physical Science. By ARTHUR A. NOYES. New York, Henry Holt & Co. 1902. Pp. vii + 172.

This is the first volume of a work on which the author is engaged, entitled the 'General Principles of Chemistry.' The present volume is introductory and has for its purpose the setting forth of the laws and general principles of physics and chemistry, so far at least as these underlie the broad subject which the author has undertaken.

The present treatment is altogether systematic and not historical, and is intended for readers and students who are making special study of what is now generally known as physical chemistry.

The book contains four chapters: I., 'The Object, the Methods, and the Sub-divisions of Science'; II., 'The Fundamental Con-

cepts of Physical Science'; III., 'The General Principles Relating to Matter,' and IV., 'The General Principles Relating to Energy.' To these are added a good general index.

The basal importance of the subjects with which these chapters have to do is well established and the author has achieved a signal success in the clear and comprehensive manner in which he has presented them to the reader.

For this is no rehash of what has been already well said by various authors on these subjects, but is clearly the result of a close personal inquiry into the underlying concepts of modern science. The reader is thus not infrequently asked to set aside the traditional form in which some concept has been hitherto expressed. The author's independence of thinking is well illustrated in his treatment of compounds and mixtures, kinetic and gravitational energy and the second law of thermodynamics.

Sometimes, however, an impression is left on the reader that the author's restatements of old laws are a little hasty and so lack the absolute singleness of idea or exact precision which should characterize any general statement in physical science.

Thus on page 117 we find Faraday's laws of electrolysis expressed as follows: *'The passage of electricity through an electrolyte is attended at each electrode by a chemical change involving a number of chemical equivalents strictly proportional to the quantity of electricity passed through, and dependent on that alone.'* This is hardly free from possible misunderstanding. A clearer statement of the facts, following the suggestion of the author, would be the following: The passage of electricity through any electrolyte is attended by chemical *changes* which involve the *same* number of chemical equivalents at each electrode, and which are directly proportional to the quantity of electricity passed through and dependent on that alone.

Similarly on page 37 the statement of the law of multiple proportion would be clearer if the words *the same* were replaced by the words *a given*, so that the law would read: 'When one element combines with another in several proportions to form different chemical compounds, the quantities of the one element which in the several compounds are combined with *a given* quantity of the other element, stand to one another in the ratio of small whole numbers.'

The chapter on energy is especially valuable. Throughout, the concept of energy is regarded as fundamental and the concept of force is made secondary. The treatment of the various forms of energy is such as to bring into prominence the factors of a particular form of energy—namely the *intensity* and *quantity* factors.

The first and second laws of thermodynamics or energetics, as our physical chemistry friends are pleased to call them, are presented and discussed with great distinctness.

Credit also should be given the author for his consistent use throughout the book of a particular and distinct symbol or letter to denote a particular and distinct physical quantity. This saves the beginner many pains. Beginners will owe him also much gratitude because he has made such free use of numerical examples to illustrate the applications of the various principles.

It is a pleasure to say that the present introductory volume is a positive addition to the literature of physical science and the students of physical chemistry, especially in America, will await with eagerness the appearance of the volumes which are to follow.

E. H. LOOMIS.

PRINCETON UNIVERSITY,
December, 1903.

SCIENTIFIC JOURNALS AND ARTICLES.

THE December number of the *Bulletin of the American Mathematical Society* contains: Report of the Boston Colloquium of the American Mathematical Society, by F. N. Cole; 'Linear systems of curves upon algebraic surfaces,' by H. S. White; 'An expression of certain known functions as generalized hypergeometric functions,' by E. T. Whittaker; 'On the factoring of large numbers,' by F. N. Cole; 'Note on the p-discriminant of ordinary linear differential equations,' by Arnold Emch; 'Hydrodynamic action at a distance,' by E. B.

Wilson; Shorter Notices of Braunmühl's 'History of Trigonometry' and of the recent reprint of Carnot's 'Treatise on heat engines' (1824); Notes; New Publications.

The January number of the *Bulletin* contains: Report of the October meeting of the American Mathematical Society, by F. N. Cole; 'Two systems of subgroups of the quaternary abelian group in the general Galois field,' by L. E. Dickson; 'The determination of the constants in the problem of the brachistochrone,' by Oskar Bolza; 'On three types of surfaces of the third order regarded as double surfaces of translation,' by A. S. Gale; 'On the generation of finite from infinitesimal transformations—a correction,' by H. B. Newson; Review of Study's Geometry of dynames, by Virgil Snyder; Review of Weber and Wellstein's Encyklopädie der Elementar-Mathematik, by D. E. Smith; Shorter Notices of the mathematical papers of the late George Green, Agnes M. Clerke's problems in Astrophysics, Müller and Presler's Constructive geometry, and Schilling's Catalogue of mathematical models; Notes; New Publications.

SOCIETIES AND ACADEMIES.

THE SOCIETY FOR EXPERIMENTAL BIOLOGY AND MEDICINE.

The fourth regular meeting of the Society for Experimental Biology and Medicine was held in the demonstration room of the department of physiology of Columbia University, at the College of Physicians and Surgeons, on Wednesday evening, December 16. Dr. S. J. Meltzer presided.

Reports of original investigations were offered as follows:

*The Changes in the Viscosity of the Blood Produced by Various Experimental Procedures, with Demonstrations:** R. Burton-Opitz.

Dr. Burton-Opitz described and demonstrated the apparatus used in determining the viscosity of the blood. This demonstration was followed by a discussion of the changes in the molecular friction of the blood after intravenous injections of distilled water, saline, dextrose and alcoholic solutions. The effect of alcohol, when introduced into the stomach and small intestine, was also noted. Next were considered the changes following subcutaneous administration of curare and the differences in the viscosity of arterial and venous blood. K, the coefficient expressing the viscosity was determined before and after each experimental procedure, two or three determinations being made in each case.

It was found that, if distilled water, in quantities of from 5 to 50 c.c., is slowly allowed to flow into the facial vein, the viscosity of the blood is increased, but the increase is not considerable. The following experiment may serve as a sample. The normal coefficient K, in a dog weighing 19.2 kilos, was 802.6, or 5.8 times greater than K for distilled water at 37° C. After the injection of 10 c.c. distilled water the coefficient showed the value 786.0, or 6.0 times greater than distilled water at 37° C. Normal saline solutions produce the reverse effect, *i. e.*, the blood becomes less viscous. In one case after injecting 10 c.c. of 0.7 per cent. NaCl solution, the viscosity of the blood fell from 5.9 to 5.6 times that of distilled water at 37° C. Concentrated solutions of dextrose (5 c.c.) injected into the facial vein bring about an increase in the viscosity of the blood which is more pronounced than that produced by distilled water. About half an hour after the injection the coefficient K shows again its normal value.

If from 3 to 5 c.c. of 10 or 25 per cent. solutions of alcohol in water are allowed to flow into the facial vein, the molecular friction of the blood becomes greater. The same result can be obtained by introducing the alcohol directly into the stomach or duodenum. 30 c.c. of a 25 per cent. solution were injected into the stomach. The viscosity determined twenty minutes later showed the value 608.09, as against 664.17, the normal coefficient. Thus, instead of being only 7.0 times greater than that of distilled water at 37° C., it changed after the injection to 7.7 times greater. An equally decisive change occurred after injecting 40 c.c. of a 25 per cent. solution into the

* The abstracts here given have been prepared by the authors themselves. The secretary has made only a few abbreviations and minor changes.

duodenum. A marked increase in viscosity also follows subcutaneous administration of curare; however, this result is not evident until the respiratory muscles become paralyzed.

Venous blood is slightly more viscous than arterial, but the difference is often very insignificant.

In all these determinations a direct parallelism exists between the viscosity values and the specific gravity. When the viscosity increases the specific gravity increases also, and *vice versa*. Not a single exception to this rule could be found.

The viscosity was also determined in a dog having very large thyroid bodies. The right gland weighed 57, the left 52 grams. The viscosity coefficient, obtained by eight determinations, showed the value 1,233.17 (specific gravity 1,05028), which means that the blood of this animal was only 3.8 times more viscous than distilled water at 37° C. The lowest previous value obtained by Dr. Burton-Opitz occurred in a dog after three days of hunger. *K* equaled in this case 1,110.3 (4.2 times more viscous).

In general it may be said that the less the viscosity the longer the period required for extra-vascular coagulation. This was especially well shown in the case just mentioned. Clotting set in after about fifteen minutes.

Survival of an Animal after Removal of both Suprarenal Capsules, due to a Previous Grafting of the Organ into the Kidney: S. J. MELTZER (for F. C. Busch and Charles van Bergen, of the Department of Physiology at the University of Buffalo).

Dr. Meltzer stated that in several instances survival of a part of suprarenal grafts was obtained after transplantation into the kidney of the same animal.

In one experiment the animal (a rabbit) survived, after apparently all other suprarenal tissue, aside from that which was grafted into the kidney, had been removed. In this case, after total removal of the left suprarenal a part of the gland, including medulla and cortex, was introduced through an incision into the cortex of the left kidney. Eighty-six days later the remaining right suprarenal was removed *in toto*. The animal survived the operation and was apparently normal for twenty-one days, at the end of which time it was killed in order to examine the graft. This was found, upon histologic examination, to have been in part replaced by connective tissue. The surviving cells apparently belong to the medullary portion of the suprarenal. The cortex had been replaced by connective tissue. Blood supply was good.

Slides showing the successful grafts were exhibited under the microscope. In this connection, also, Dr. Meltzer showed, under the microscope, a section of Zuckerkandel's organ, the chromophilic bodies of which are similar in nature to the chromophilic granules of the medullary portion of the suprarenal capsule.

On the Absence of a Cane Sugar Inverting Enzyme in the Stomach: GRAHAM LUSK.

It was shown by Professor Lusk that free hydrochloric acid and not an enzyme caused the inversion of cane sugar in the stomach.

A new Head Holder for Rabbits, with Demonstration: FREDERIC S. LEE.

The following reviews were made:

The Action of Potassium Cyanide upon the Unfertilized Egg: HOLMES C. JACKSON.

Loeb and Lewis were the first to note the fact that unfertilized eggs (of the sea urchin), when placed in *n*/1,000 KCN solution, retain their capability of fertilization much longer than when suspended in normal sea water. This was ascribed to the action of the KCN in inhibiting intracellular autolytic processes which lead normally to maturation and finally death. The bactericidal action of KCN was excluded, as the result of experiments in which eggs apparently died as rapidly in sterile as in putrid sea water.

Gorham and Tower's experiments in the same connection indicated, on the other hand, that the effect of KCN was entirely bactericidal. The sterile eggs retained their capacity for fertilization longer under absolutely sterile conditions than when placed in *n*/1,000 KCN.

As the question now stands there exist two almost identical series of sterilization experiments by two pairs of investigators, with results diametrically opposed to each other. Critically considered, the more carefully con-

ducted experiments seem to be those by Gorham and Tower; and in the lack of further evidence in favor of an intracellular action of KCN in this connection, we must conclude that the destruction of the bacteria by the KCN removes the condition which causes the death of the cell, and in the absence of which the eggs retain their potential power for growth after fertilization.

Results of Recent Investigations in Proteid Chemistry: P. A. Levene.

Recent work on the chemistry of the proteid molecule has furnished explanation of many biological phenomena. Thus, in certain pathological conditions there appears in the urine a sulphur and nitrogen-containing substance, cystin. The source of the substance in the organism had been unknown, until through the efforts of Mörner and Embden and others, its radical was demonstrated to be a normal constituent of the proteid molecule.

The chromatin of a developed cell differs from that of an unfertilized egg by the presence in it of radicals of purin bases. It is probable that these bases are derived from the histidin radical, which is also a normal constituent of proteids.

Hemoglobin is known to be absent from the unfertilized egg and it appears only in course of development of the embryo. It was shown recently that the non-proteid part of hemoglobin is a pyrrol derivative and it is probable that a pyrrol radical is present in the proteid molecule. Chlorophyl is also a pyrrol derivative, a fact further establishing its close relationship to hemoglobin.

The work of Emil Fischer points to the way in which the various component radicals may combine in order to form the proteid molecule, and makes probable the eventual synthesis of true proteid material.

New Members.—The gentlemen named below were elected to membership: A. C. Abbott, Isaac Adler, B. H. Buxton, J. McK. Cattell, H. L. Cushing, E. K. Dunham, Simon Flexner, Reid Hunt, Hugo Münsterberg, J. A. Murlin, Horst Oertel, E. L. Opie, Theobald Smith, A. B. Wadsworth, R. S. Woodworth, Naohidé Yatsu.

William J. Gies,
Secretary.

The New York Academy of Sciences. Section of Anthropology and Psychology.

The section met on November 23, in conjunction with the American Ethnological Society. A paper was read by Dr. Clark Wissler, 'Recent Researches on the Decorative Art of the Plains Indians.'

It was demonstrated by specimens and explanations that among the Indians of the plains may be found a type of graphic art that is purely decorative in contrast to a type that is absolutely symbolic. In addition, a transition type occurs in which both the symbolic and the asthetic motives function. The whole of this art is the work of women. In the purely decorative art complex geometric designs are built up from simple geometrical elements. These elementary designs have technical names and are worked into compositions according to recognized principles and standards. In the symbolic art the designs are conventional representations of objects with sacred or mystic associations and are realistic in motive. While a number of conventional designs are used which are known once to have possessed symbolic value and to have originated in realistic motives, the majority of design elements do not appear to have originated in this way. Their occasional use in a symbolic sense is an afterthought and a makeshift. From which it appears that the graphic art of these Indians, as we find it to-day, is an objective development in contrast to the subjective symbolism of other tribes.

James E. Lough,
Secretary.

Section of Geology and Mineralogy.

The regular meeting of the section took place December 14, 1903, with Professor James F. Kemp in the chair.

The first paper on the program was 'Explorations and First Ascents in the Canadian Rockies,' by Professor Herschel C. Parker.

This paper occupied the evening. It consisted of an illustrated lecture describing the section of the Rocky Mountains in British Columbia and Alberta known as the 'Canadian Alps.'

In a brief introduction an explanation was

given of the physical characteristics that determine the alpine nature of mountain ranges, and it was pointed out that the Rocky Mountains of Canada may justly be termed the 'Switzerland of America.'

A series of more than 100 lantern slides was shown, many of them illustrating six first ascents made by the lecturer. These summits were: Mt. Dawson, the highest peak of the Selkirks; Mt. Goodsir, one of the highest and most difficult peaks in British Columbia; Mt. Lefroy, Mt. Hungable (the 'Chieftain'), Mt. Deltaform and Mt. Biddle, these latter peaks being situated in Alberta near Lake Louise. The summits of some of these mountains were previously thought to be practically inaccessible and the climbs were attended with the very greatest difficulties. Mt. Lefroy was climbed by the lecturer in 1897, Mt. Dawson in 1899 and the remaining four summits during the past season.

The lecturer also briefly described an interesting trip of about 100 miles north of the railroad to Wilcox Pass, where the Saskatchewan and Athabasca Rivers take their rise.

The following two papers were submitted for reading by title and subsequent publication:

Gem Minerals of Southern California: DR. GEORGE F. KUNZ.

In this paper the author said in part that California, especially in its southern portion, had of late years produced the most interesting gem minerals of any state in the union. First came the magnificent series of colored tourmalines, described in recent reports of the Division of Mining and Mineral Resources, U. S. Geological Survey (1899, p. 38; 1900, p. 33; 1901, p. 31); next, the remarkable rose-beryl from Mesa Grande and Pala (*ibid.*, 1900, p. 32), and lastly, the amethystine spodumene (kunzite), in crystals which for purity and beauty of color are unrivaled by any other mineral of North America.*

Thus far the minerals are confined to two counties. The tourmalines occur near San Jacinto, in Riverside County, and at Mesa Grande and Pala, in San Diego; the pink beryl, in small amounts, at the two last-named localities; and the lilac spodumene at Pala, and also to some extent at Coahuila, in Riverside County, in crystals of similar character but smaller. Other interesting gem minerals are now coming to light in association with the preceding ones. With the spodumenes from Coahuila have been found beautiful beryls, some yellow, closely resembling those from Sarapulka in the Ural Mountains, others pale green and even colorless. Some of the yellow crystals are finely formed, and the others show instances of remarkable etched faces, similar to the crystals from Sarapulka in Perm; while others are almost as delicate as a darning needle. The etching in certain of these is most curious; crystals of three inches long and an inch across, colorless and transparent as the finest rock crystal, are covered all over the prismatic and basal planes with the most complicated etching, and within are hollow, made up of interlocking plates, as it were, exceedingly clear and brilliant.

From Pala came a fine doubly terminated, detached pink beryl which measured 10 cm. by 5 cm., and which was quite transparent and an object of great beauty.

Another mineral recently observed at Coahuila is spessartite (manganese-aluminum garnet), in trapezohedral crystals of remarkable beauty. Some of these are absolutely pure and measure from 6 to 10 mm. in diameter, while large ones are as much as 30 mm., but less perfect. They are implanted upon crystals of albitic feldspar, recalling strongly the occurrence at Amelia Court House, Virginia. The smaller crystals are exceedingly brilliant and beautiful, of a honey-yellow color, deepening to orange-red; others are quite large, but not transparent. The crystalline form is that of the trapezohedron, *n*, in combination with the rhombic dodecahedron, *d*.

Lastly, and of great interest, is the first-noted occurrence in the state of topaz, in distinct and beautiful crystals. The source is the well-known mineral locality three miles from Ramona, in San Diego County. One crystal is absolutely transparent, of a pale blue color, like those from the Ural region, and measures 2 cm. by 1 cm. by 5 mm. The faces

* *Amer. Jour. Science*, Vol. 16, November, 1903; *N. Y. Acad. Sciences*, October 19, 1903.

c and *X* are entirely absent; those present are *p, d, o, f* and *g*, with *m* and *l* of the prism; the pyramid faces are etched. The general character strongly recalls the Alabashka type of the Urals, and this likeness would suggest that the minerals to be found with it will also resemble those of that noted locality. Other crystals are perfectly colorless, but with the same general form and proportions; those of about one centimeter in length are extremely brilliant, the larger ones less so externally, but clear within. It is of great interest that this belt of rare species which traverses the state in its southern portion gives indication of further occurrences of remarkable minerals there to be found.

Clackamas Meteoric Iron: Dr. George F. Kunz.

There has lately been discovered in Oregon an enormous iron meteorite, ranking with the two immense ones found respectively by Lieutenant Peary in Greenland and by Professor H. A. Ward in Mexico. This is a mass of iron, measuring ten feet in length by seven in width and five in height, pitted in the usual manner, but in an extensive degree, and at one point even perforated, so as to leave an opening through it as large as a man's hand. It was discovered in the autumn of 1902 by a prospector, Mr. Dale, on land belonging to the Oregon Steel and Iron Company, some two miles south of Oregon City, in Clackamas County. The official statement of its location is T. 2, S.; R. 1, E. of Willamette Meridian. It was dug loose from the soil and removed on a truck to adjacent land belonging to Mr. Ellis Hughes, where it now lies, subject to a claim by the company and a suit now in progress. The material has been subjected to analysis by a local chemist and found to contain a small percentage of nickel; but the exact figures are not yet in the author's possession. According to Mr. A. W. Miller, of Portland, Oregon, from whom most of the facts have been learned, a piece which he examined for structure did not show the Widmanstatten figures, but a marked cubical structure, with very high silvery luster. A fine photograph sent by him to the author shows the mass as roughly conical or dome-shaped, on an elliptic base, wonderfully pitted, and with the hole through its lower portion. Men standing by it indicate its size, which is perhaps as large as that of any other meteorite known.

Edmund Otis Hovey,
Secretary.

MICHIGAN ORNITHOLOGICAL CLUB.

The last meeting of the Michigan Ornithological Club for the current year was held at the Detroit Museum of Art on December 6. President Adolphe B. Covert presided. There was a good attendance and the papers presented were of much interest. The program was as follows:

Norman A. Wood: 'The Discovery of the Breeding Area of Kirtland's Warbler in Michigan.'

Alexander W. Blain, Jr.: 'Observations made on the Habits of Birds of the Family Mniotiltidæ in Monroe County, Michigan, by Jerome Trombley, during the years 1875–81.'

J. Claire Wood: 'Some Late Breeders.'

Edward Arnold: 'Nesting of the Sandhill Crane in Michigan.'

Professor A. H. Griffith: 'Birds in their Relation to Art.'

Following the papers a business session was held. Dr. J. A. Allen, of the American Museum of Natural History, Wm. Brewster, of Cambridge, and Robert Ridgway, of the Smithsonian Institution, were elected to honorary membership. Many new active members were elected. The constitution was amended so as to allow quarterly instead of monthly meetings. A class of patrons was created.

The next meeting of the club will be held at the Detroit Museum of Art on February 5, 1904. Visiting ornithologists are cordially invited to attend.

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DISCUSSION AND CORRESPONDENCE.

THE WORD BAROMETER.

To the Editor of Science: In my letter of August 28 I expressed the belief that the letter of John Beale to Robert Boyle bearing date February 6, 1665, should read 1666. Since then Dr. J. B. Nichols, of Washington, D. C., has called my attention to the system of

double dating in vogue during the time that both church and civil almanacs were in use. During this time a date falling between January 1 and March 25 would by the church almanac be a year earlier than the same date on the civil almanac. This was sometimes indicated by a double date thus, February 6, 1665/6.

This was a point that I had overlooked, as had also Drs. Rotch and Bolton. A reexamination of the various dates and of their context leads to the following conclusions. John Beale's letter was written February 6, 1665/6. The paper cited by Dr. Rotch and myself is of date March 24, 1665/6. Henry Oldenburg's letter to Robert Boyle, cited by me, is of date March 19, 1665/6.

During the year 1665 several instances of the use of the word 'barometer' are to be found in Robert Boyle's correspondence. In Robert Boyle's paper of April 2, 1666, he refers to 'barometrical observations' made by John Beale; these observations Henry Oldenburg transmits to Robert Boyle on December 19, 1665 (Vol. V., p. 343), and again on December 30, 1665, and on January 16, 1665/6.

More interesting than the above is what would seem to be the original passage in which the word barometer is used. This passage I found by following up the reference in John Beale's letter to the three papers on 'thermometers and baroscopes.' A close examination of Robert Boyle's papers shows these to be three papers printed with the 'History of Cold' in the spring of 1664/5. They are entitled 'New Thermometrical Experiments,' and are preliminary to the 'History.' There is also an introductory note by Henry Oldenburg of date March 10, 1664/5, and beginning thus: 'I am fully persuaded, you will much rejoice to see that exquisite searcher of nature, the illustrious *Robert Boyle*, come abroad again, * * *' (Vol. II., p. 231). A little further on he says: "I am now to advertise you of one or two circumstances necessary to be taken notice of in its perusal. One is that the noble author being at Oxford, when the book was printed at London, he hopes the reader will not impute to him the errors of the press, which yet he is persuaded will not be many, and out of which must be excepted a blank or two, occasioned by this, that the author's papers being near two years since given to be transcribed to one. * * *" This passage shows that the papers were written by Robert Boyle prior to March, 1662/3.

Turning to the author's preface we find the following, "* * * how great a power my friends have with me * * * the reader may guess by the preamble he will find prefixed to the first title of the ensuing history. For by the date of that he will see how early my papers about cold were to have been communicated." The preamble bears date 'Little Chelsea, February 14, 1662, S. A.,' or 1663 civil almanac.

Turning to discourse I., we find the following interesting passage: "Among the several notes I find among my loose papers and in a diary I kept for a while of these observations, I shall content myself to transcribe the following two. * * * The first of these memorandums runs thus. Last night I took notice that there was but one or two divisions difference betwixt the two thermometers, but upon such a change of weather, that happened this day, as made me imagine that the atmosphere would be lighter than before, consulting the barometer (if to avoid circumlocutions, I may so call the whole instrument wherein a mercurial cylinder of 29 or 30 inches is kept suspended after the manner of the Torricellian experiment) * * *" (Vol. II., p. 244b). The date of the diary from which these remarks are taken is not given, and the best that can be concluded from a reading of the whole paper is to say that the date must be prior to March, 1662/3, and probably prior to February 14, 1662/3. Later on in the same paper the word baroscope is used.

It is a pity that Robert Boyle had not earlier followed the determination of giving all requisite dates, expressed by him in the following letter to Henry Oldenburg, dated October 26, 1667. "* * * Care will be taken for the future, that the letters I send you be dated. * * * And I am the more solicitous about this matter, because frequent experience shews us how much our English have lost, for want of being so; and (which is more

considerable) how difficult it is, otherwise, to avoid the occasions of personal disputes, or reflections; which, for my part, I heartily desire to shun" (Vol. V., p. 252b).

One can not but conclude, judging from the phraseology, that the passage in the *Phil. Trans.* cited by Dr. Bolton is from the same pen as Henry Oldenburg's prefatory note. Further evidence of the same authorship is found in the capitalization, following, as it does, the German method. Now Robert Boyle would not be likely to use this mode of writing, while Henry Oldenburg, being a native of Bremen in lower Saxony, might easily have lapsed into the style of his native tongue.

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SPECIAL ARTICLES.

COLOR INHERITANCE IN MICE.

Within the last few years great interest has been aroused by the rediscovery of Mendel's Law of Dichotomy in plant hybridization. This law has been confirmed for many species of plants, especially by De Vries (1902, pp. 146–151, etc.), Correns, Tschermak and others. The study of mice, rats and rabbits has yielded a partial confirmation of this law for animals. I wish here to contribute additional although too meager data drawn from my experiments of the past four years.

The two great laws enunciated by Mendel were these: Of the two antagonistic peculiarities possessed by two races that are crossed, the hybrid, or mongrel, exhibits only one; and it exhibits it completely, so that the mongrel is not distinguishable as regards this character from one of the parents. Intermediate conditions do not occur. That one of the two parental qualities that alone appears in the mongrels is called dominant; the other recessive. Second, in the formation of the pollen or egg-cell the two antagonistic peculiarities are segregated; so that each ripe germ cell carries either one or the other of these peculiarities, but not both. It is a result of the second law that in the second generation of mongrels each of the two qualities of their grandparents shall crop out on distinct individuals, and that the recessive quality shall appear in 25 per cent. of the individuals, the remaining 75 per cent. having the dominant quality. Such recessive individuals, crossed *inter se*, should never produce anything but recessive offspring.

Now experiments with animals have revealed the existence of recessive qualities—*e. g.*, in mice, when white and wild gray are crossed and the mongrel offspring are crossed *inter se*, the second mongrel generation will yield some white mice, and such white mice, bred *inter se*, will thenceforth produce only white mice. These results have been got by Crampe (1885), von Guaita (1898, 1900)—cf. Davenport (1900)—Cuénot (1902, 1903)—cf. Bateson (1902, p. 173)—Darbishire (1902, 1903), Castle (1903) and Bateson (1903). Is the percentage of the recessive individuals always 25? In such a second mongrel generation Cuénot (1902) found 162 gray and 57 albino individuals, or 74 per cent. to 26 per cent., and in von Guaita's breedings between walzing and albino mice the crossed gray hybrids gave 25 per cent. albinos; results that accord with theory. But instead of the 75 per cent. gray which Mendel's law calls for, von Guaita got 57 per cent. gray and 18 per cent. walzing mice of gray, gray-white, black, and black and white colors. Rabbits gave Woods (1903) only 21 per cent. instead of 25 per cent. of the recessive type in the second mongrel generation, and in crossing hybrids with albinos he got only 40 per cent. albinos instead of 50 per cent., as theory demands.

The discussion concerning the validity of Mendelism for mice has been based chiefly upon crosses between albinic mice on the one hand (Crampe, Cuénot, Castle and Allen) and gray or walzing mice on the other (Haacke, von Guaita, Darbishire). Bateson (1903) alone has recorded, without details, the results of crossing mice of varied colors. His data will be referred to in the following account of my experiments.

A. THE OFFSPRING OF MICE OF THE SAME COLOR.

I. *Albino* × *Albino*.—This cross appears to produce only albinos. Bateson (1903, p. 76) has examined the evidence and finds only one

doubtful case where white mice produced colored offspring. In two crosses of white parents I got nine offspring; all were white.

II. *Yellow* × *Yellow.*—1. Yellow-red (8)* × yellow-red (7). The mother (8) was yellow-red with a patch of white below; the father was pure yellow-red. Of the offspring one was pure yellow-red like the father, two were brownish yellow above and much lighter below, one was brownish red with patches of white, and five were chocolate with yellow flanks and patches of white above and below. Thus, one bred true to the father but the remainder were much darker and had a mixture of colors.

2. Muddy yellow $\left(35 \begin{cases} \text{white (6)} \\ \text{yellow (7)} \end{cases}\right) \times$ yellow (7). Of the four offspring one was a uniform light yellow (57); one was yellow above and white below and on the flanks (59); one was dirty yellow above, white below (58); and the last was wild-mouse gray (or agouti) above and white on belly and flanks. The result in both cases is seen to be very variable.

III. *Black (2) and Black (2).*—My blacks seemed delicate and relatively infertile, so that of two crosses only two individuals survived —both were black. Black behaves something like albinism. Is it not likewise recessive?

IV. *Chocolate* × *Chocolate.*—Chocolate is a broad class including various shades of color from a dark red-gray to a dark red-yellow. I raised four families as follows: 1 and 2. Chocolate (10) × Chocolate (1) with nine offspring, as follows: Uniform chocolate, nos. 22, 23, 26, 66 and 65. Chocolate above, more or less white below, nos. 67, 68. Chocolate with white spots, nos. 24, 25.

3. Chocolate $\left(66 \begin{cases} 10 \\ 1 \end{cases}\right) \times$ Chocolate $\left(25 \begin{cases} 10 \\ 1 \end{cases}\right)$.

These full siblings† of chocolate parents produced five offspring. All were of a uniform chocolate color.

4. Chocolate $\left(67 \begin{cases} 10 \\ 1 \end{cases}\right) \times$ Chocolate $\left(25 \begin{cases} 10 \\ 1 \end{cases}\right)$.

* The numbers in parentheses are those of the pedigree mice.

† Sibling (Pearson) is a term applicable either to brother or to sister.

There was only one survivor of this pair; it was chocolate colored excepting for some white on the belly.

Thus the chocolate color shows itself rather stable, especially in the second pure bred generation.

B. THE OFFSPRING OF MICE OF DIFFERENT COLOR.

I. *Gray and White.*—This cross has been made by several investigators, as indicated above. The usual result is that the offspring in the first filial (mongrel) generation (F_1 in Bateson's nomenclature) are prevailingly gray like the wild house mouse. My own experience is partly confirmatory.

A wild house mouse (15) × albino (5) gave five offspring: nos. 47 to 51. Four of these resembled the wild mother in coat excepting that they were yellower on the back of the neck and of a cream color in the region between the fore legs and also between the hind legs. Also the coat had a richer, glossier look than the mother's. The other one of the offspring was generally agouti above and ashy below, but the hairs of the ventral part of the shoulder girdle were yellow tipped, there was a mid-ventral white patch and there were five distinct white patches on the dorsal side. These were unlike anything in the mother, and indicated particulate inheritance by the mongrel from both parents, but especially from the mother. My results agree with those of Crampe, who found that similarly bred rats give in F_1 either uniformly gray or gray and white. Darbishire (1903) crossing walzers and albinos finds that the mongrels have the less white the purer bred the albinos are, and von Guaita's pure-bred albinos gave all gray offspring when crossed with walzers. I know nothing of the ancestry of the albino (5); but it may be inferred that it was not pure bred. With an albino that had been bred pure for two generations I got the following result:

$$\text{Gray}\left(54 \begin{cases} 21, \text{ chocolate } (10 \times 1) \\ 29, \text{ house} \end{cases}\right) \times \text{white}\left(18 \begin{cases} 4, \text{ white} \\ 5, \text{ white} \end{cases}\right).$$

Five offspring were obtained all gray like a

house mouse, but of a lighter color. Probably the earlier crosses of Crampe (1877, p. 390, 391) with white and gray rats that led him to the conclusion that in inheritance the color of the species shuts out the color of the variety were made with pure bred rats. Cuénot crossing grays and albinos got gray mice without exception in the F_1 generation.

From the foregoing the conclusion may be drawn that the offspring of pure-bred gray mice crossed with albinos inherit chiefly from the wild form but that the color is slightly modified, particularly when the albinos are not pure bred, first by an increase in the yellow and, secondly, in some cases, by the presence of white. Gray is dominant over albinism but the soma derived from hybrid germ cells shows traces of the albinic blood. The dominance is incomplete. The dominance, so far as it goes, accords with De Vries's (1902, p. 145) generalization that the older type or the wild species is dominant over a more recent type or a cultivated variety.

When these gray mice are crossed *inter se* there result gray mice and white mice in the proportion of three to one (Cuénot; Castle and Allen, 1903), and the albinos show themselves purely recessive. That all recessive mice are, however, not alike, but differ according to their ancestry has been argued by Darbishire from the fact that pure bred albinos transmit less to F_1 than albinos do that are derived from a mixed ancestry.

II. *Wild Gray* (45) × *Black* (9).—Two offspring of this cross were essentially of the wild, maternal color.

III. *Wild Gray* (29♂) × *Chocolate* (21 { 10 / 1).

—Nos. 52 and 54 were marked like the wild gray but were darker. No. 53 had a dark back, a light yellow belly and white on the shoulders and in the middle of the right flank. No. 55 had a back like the house mouse, but its shoulders were white and its belly yellow and white. In these offspring there was an attempt at least at blending and there was a cropping out of an ancestral white, but on the whole the gray dominated.

IV. *Black* × *Albino*.—This cross was made twice.

1. Black (19 { 2, black / 9, black) × albino (18 { 4, albino / 5, albino).

Five young were obtained, all reversions, being of typical wild mouse color except that two of them had white spots on the belly.

2. Black (126) × Albino

102 { 57, reversion { 35, yellow (6, albino × 7, yellow) / 7, yellow
18, albino { 4, albino. / 5, albino

—The two offspring were reversions, but one had a white spot at the center of the belly. These two matings indicate that neither black nor white is dominant, but that the repressed ancestral gray character is, as it were, liberated.

V. *Black* (137) × *Yellow*

136 { 102, albino
130, reversion { 102, albino / 126, black }.

—The single offspring was a typical reversion except that the front part of the belly and the flanks were white. Bateson (1903, p. 85) states that Miss Durham got sables and dingy fawns and even blacks from this cross. In any case there is no evident dominance.

The following cases are still more complex.

VI. *Reversion* (32 { 6, white / 7, yellow) × *Gray* (47 { 15, wild / 5, white).

—There were two of the progeny of this pair that survived infancy—both were of the typical wild mouse color.

VII. *Reversion* { 109 { 57, gray { 35, yellow / 7, yellow
18, white { 4, white / 5, white }

$$\times \textit{Reversion}\left\{117\left\{\begin{matrix}77,\text{ yellow}\left\{\begin{matrix}34,\text{ yellow}\\42,\text{ yellow}\end{matrix}\right.\\48,\text{ gray}\quad\left\{\begin{matrix}15,\text{ wild}\\5,\text{ white}\end{matrix}\right.\end{matrix}\right.\right\}.$$

—There were three offspring; one was uniformly black (a color not found in the ancestry for at least three generations) and two were white. Black rats were got by Crampe (1877, p. 394) by crossing mongrels between wild and white-and-black rats; and black mice by von Guaita by crossing piebald dancing mice with albinos.

$$\text{VIII. } \textit{Piebald}\left(34\left\{\begin{matrix}6,\text{ white}\\7,\text{ yellow}\end{matrix}\right.\right)$$
$$\times \textit{Gray-yellow}\left(42\left\{\begin{matrix}8,\text{ yellow}\\7,\text{ yellow}\end{matrix}\right.\right).$$

—Of the six offspring four (nos. 77, 78, 79, 81) had the back colored yellow-red. In matching the color with the color wheel red, orange and yellow were found to constitute 60 per cent. to 70 per cent. of the color. In no. 82 the dorsal pelage was yellow-chocolate, with the color formula, N51, R28, Y12, W9;* and in no. 80 it was chocolate, with the color formula, N76, R13, Y4, W7. Four had some white on the belly or flanks. In this cross a new color—chocolate—arose, which I interpret to mean that some of the primitive gray was added to the yellow; that is, there was a partial reversion. Otherwise the yellow is dominant.

$$\text{IX. } \textit{Gray and White}$$
$$\left(57\left\{\begin{matrix}37,\text{ yellow }(6,\text{ white}\times 7,\text{ yellow})\\7,\text{ yellow}\end{matrix}\right.\right)$$
$$\times \textit{White}\left(18\left\{\begin{matrix}4,\text{ white}\\5,\text{ white}\end{matrix}\right.\right).$$

—There were eight offspring, three albinos and five gray. Four of the latter had white patches on the sides, legs or middle of the belly. This is like the case described by Castle (1903, p. 542).

C. SUMMARY OF RESULTS.

When the parents are of the same color, especially if they are pure bred, there is a strong tendency for the offspring to be of the same color as the parents. In the case of albinos this tendency is so strong that the offspring are probably always albinic; if both parents are black the tendency to black offspring is likewise very strong; if chocolate, the result is more variable; if yellow, still more intermediate. The results indicate that there are different degrees in the strength of inheritance of different colors.

When the parents are of dissimilar color the offspring show different kinds of inheritance in the different cases. When gray and white are crossed the offspring are gray with a little white, and this white is the more reduced the purer bred the albinic parent; the gray is dominant. Likewise in the cross of gray and black, black is quite shut out, and the same is true of gray and piebald rats (Crampe, 1877, p. 394). The wild, gray color is strongly prepotent. Melanism and albinism act quite similarly in crossing. Both are in the nature of 'sports.' Perhaps 'purity of the germ cells' is the mechanism of isolation for which we have been so long looking, by which mutations are preserved from the 'swamping effects of intercrossing.'*

When gray and chocolate are crossed the gray is incompletely dominant. When black and white are crossed, typical reversions appear; neither color is dominant. When black is crossed with yellow the result is highly variable. If white and yellow be mixed in various proportions for several generations the progeny takes on various shades of yellow and may acquire the wholly new color of chocolate. Similarly, black may result from a mixed ancestry in which there is no black. The study of the cropping out of new colors certainly forms an enticing subject for further inquiry.

D. BEARING OF THE RESULTS ON MENDEL'S LAW.

The enthusiasm kindled by the discovery of a new law leads us to go to extremes, to as-

* N, nigrum, black; R, red; Y, yellow; W, white. The numbers are percentages.

* Since the above was written I have received Castle's paper in SCIENCE for December 11, 1903, in which he states that the long-haired character in the Angora guinea-pig is recessive. This character is probably a mutation, and as such behaves in accordance with the above hypothesis.

sume its universal validity, and to overlook apparent exceptions. Those who insist upon a critical examination of all evidence against as well as for the theory run the risk of being regarded as lukewarm and as clogs on the wheels of progress; but they should not be deterred on that account from a full examination of all the facts in the interest of truth.

Mendel's Law is an hypothesis of great value both because it fits so many cases of inheritance and because it is stimulating to experimental investigations which will determine the limits within which it is valid.

The first limitation of Mendel's Law is stated by De Vries (1902, p. 141), who certainly can not be accused of lukewarmness toward the theory, since he was its rediscoverer. He says in effect: Mendel's Law of dichotomy holds in general only for phylogenetically recent characters, the so-called racial characters; and for only a part of those—what part we do not know. Even Mendel recognized that his rule was not generally applicable.

The second limitation of Mendelism concerns his theory of dominance. Sometimes when dissimilar racial characters are crossed one of them is dominant, and sometimes not. For example, gray is (within limits) dominant over white or black in mice, but when black and white or black and yellow are crossed there is no dominance of one color over the other; both are recessive and a reversion to the primitive gray occurs. The whole hypothesis of the purity of the germ cells will bear careful scrutiny. The best example of a recessive character in animals is albinism, but even in this case, as Darbishire has pointed out, the recessives can not be perfectly pure and independent of ancestry, for the mongrel mice coming from a recessive crossed with a gray differ according to the ancestry of the recessive. The result of this study is, I think, to add evidence that Mendel did not discover all the important laws of inheritance, and that further investigation will unquestionably reveal other and still broader principles of heredity.

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Hull Zoological Laboratory,
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December 13, 1903.

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CURRENT NOTES ON METEOROLOGY.

METEOROLOGICAL BIBLIOGRAPHY.

To the 'Note on Meteorological Bibliographies,' published in SCIENCE for December 18, p. 795, there should have been added a reference to one other publication which contains a valuable list of titles in physics and meteorology. This is the *Fortschritte der Physik, Halbmonatliches Litteraturverzeichniss,* an octavo publication, issued twice a month, now in its second year. The *Fortschritte der Physik,* already well known in this country, contains reviews of publications in astrophysics, meteorology and geophysics, but the *Fortschritte* necessarily appears some time after the date of the books and articles reviewed therein. The object of the new *Halbmonatliches Litteraturverzeichniss* is to publish the titles of all physical books and articles immediately after their issue, and without reference to the later reviews in the larger volumes of the *Fortschritte.* The matter is in the hands of the Deutsche Physikalische Gesellschaft, the editor for 'Cosmical Physics' being the well-known meteorologist, Dr. Assmann. No one can fail to appreciate the advantage of this bibliography, which appears frequently, is well edited, and will prove of the greatest service to meteorologists. It is altogether the best current meteorological bibliography published, although one could wish that an author catalogue were included, and that the same classification of subjects were used as in the 'International Catalogue' (or a better one). The price of the *Litteraturverzeichniss* is four Marks yearly.

CLOUD OBSERVATIONS IN INDIA.

OBSERVATIONS of the movements of the upper clouds were made at six stations in India during the period 1895–1900, and the results are now discussed by Sir John Eliot in Vol. XV., Pt. I., of the Indian Meteorological Memoirs (pp. 112, Pls. XII., Calcutta, 1903). Nephoscopes of the Finemann pattern were used. No observations of altitude are included. The discussion concerns the directions of movement of each cloud type at each station, during dry and wet seasons. These being the first considerable Indian contributions to the study of the upper air movements as shown by cloud directions, the results are especially noteworthy. The movement of cirrus and cirro-stratus clouds is remarkably steady at the four northern stations (Simla, Lahore, Jaipur and Allahabad) during the dry season, being from almost due west, *i. e.,* in accordance with theory. The number of observations at Vizagapatam and Madras is small, but the indications are that the upper air movement recurves from southeast through south to southwest in the southern portions of India, also in general accordance with theory. The lower as well as the upper air movement is from west over the whole of northern and central India during the dry season, the direction of movement of the alto-cumulus, cumulus and cumulo-nimbus being almost as regular as that of the upper clouds, but more southerly. During the rainy season there is great variability and unsteadiness in the cloud movement up to the elevation of the highest cirrus at Allahabad, which is in the center of the Indian trough of low pressure at that season. Photogrammetric observations at Allahabad in 1898–1900 showed that the mean altitude of the cirrus in the rainy season is 32,654 feet. Hence it appears that the unsteady movement in the monsoon trough extends up to 30,000 feet at least, and perhaps even to 40,000 feet. The regular movement in the higher atmosphere (from west to east) is then suspended, or else occurs at a greater elevation than in the dry season.

AIR PRESSURES IN INDIA.

VOL. XVI., Pt. I., of the 'Indian Meteorological Memoirs' contains the 'Normals of the Air Pressure Reduced to 32° F. and Constant Gravity, Lat. 45,' by Sir John Eliot. The memoir includes the monthly and annual means of the barometric observations at all observatories in India which have been in operation at least twenty years. At most of the observatories, the observations date from 1875, when the department was 'imperialized.' In June, 1878, the government of India sanctioned arrangements for the publication of a daily weather report, which included observations made at 10 A.M., at about 100 stations.

The hour was later changed to 8 A.M. It is to be noted that certain persistent discrepancies appear when the observations, after reduction to sea-level, are compared, the most noteworthy cases being those of stations which are more or less completely shut in by hills of considerable elevation. The result of this condition is to check somewhat the horizontal movement of the air, and to give too high a pressure during the morning. At the three stations where this topographic effect is most marked the excess of pressure averages about .02 inch at 8 A.M.

NOTE.

It is well known that the winter snowfall is a great help in lumbering operations in our northern forests, for it greatly facilitates the labor of hauling out the trees. In a recent article on the 'Forest School at Biltmore' (*Forestry and Irrigation,* November), Dr. Schenck notes, among the disadvantages of the Biltmore forest tracts, the lack of winter snows, which allow 'cheap sleighing to take the place of expensive wagoning.'

R. DeC. Ward.

THE ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS.

The twentieth annual meeting of the association was held at the Columbian University, Washington, D. C., on November 19, 20, 21, with an attendance of 150, the largest on record. A large part of the meeting was devoted to the reports of the referees and associate referees on the analysis of foods. Dr. William Frear, as chairman of the committee on pure food standards, reported that those on meats and the principal meat products, milk and its products, sugars and related substances, condiments (except vinegar), and cocoa products, were ready for adoption as official and the proclamation so declaring them was signed by Secretary Wilson on November 21. The circular containing these standards is now in press and will be ready for distribution in a short time.

Slight changes were made in the official methods for the analysis of sugars and insecticides and a new division of the work was created by a motion to appoint a referee on drugs. A resolution was adopted requesting the Bureau of Standards through its chemist to participate in the work of the referees fixing standard methods of analysis. The committee on fertilizer legislation was instructed to prepare a bill for submission to Congress regulating interstate commerce in fertilizers and fertilizing materials.

The executive committee was given permission to call the meeting of the association next year at St. Louis and there is every probability that such action will be taken. The officers elected are as follows:

President—M. E. Jaffa, Berkeley, Cal.
Vice-President—C. L. Penny, Newark, Del.
Secretary—H. W. Wiley, Washington, D. C.
Additional Members of the Executive Committee—W. P. Headden, Fort Collins, Colo.; W. R. Perkins, Agricultural College, Mass.

SCIENTIFIC NOTES AND NEWS.

Mr. Shyamaji Krishnavarma, of India, has offered $5,000 to Oxford University to establish a lectureship in honor of Herbert Spencer to be known as the Spencer Lectureship.

The prize for French contributions to science given by M. Osiris through the Paris Press Association has been divided between Mme. Curie and M. Branly. Mme. Curie receives 60,000 francs for her work on radium and M. Branly 40,000 francs for his work in connection with wireless telegraphy.

The sixtieth birthday of Dr. Robert Koch was celebrated on December 11. A portrait bust was unveiled in the Institute for Infectious Diseases, Berlin, a museum for bacteriology was established and a *Festschrift* is in press. Dr. Koch expects to return from South Africa in March.

At the St. Louis meeting of the Astronomical and Astrophysical Society of America the following officers, including those who hold over, were elected for the ensuing year: *President,* Simon Newcomb; *First Vice-President,* George E. Hale; *Second Vice-President,* W. W. Campbell; *Secretary,* George C. Comstock; *Treasurer,* C. L. Doolittle; *Councilors,* Ormond Stone, W. S. Eichelberger, E. C. Pickering, R. S. Woodward.

AT the St. Louis meeting of the Geological Society of America, Professor John C. Branner, of Stanford University, was elected president and Professor H. L. Fairchild, of the University of Rochester, was reelected secretary. We regret that the names were accidentally interchanged in the last issue of SCIENCE.

GOVERNOR BATES, of Massachusetts, in his annual message recommends the appointment of a state forester and greater attention to the forest resources of the state.

PROFESSOR N. S. SHALER, of Harvard University, will spend the next four months abroad traveling in Egypt, Asia Minor and Greece.

DR. J. C. BRANNER, professor of geology at Stanford University, has received leave of absence and is about to go to Europe.

The American Geologist states that Mr. O. H. Hershey has charge of the gold mine in Humboldt County, California, and is studying the geology of the Klamath Mountains.

AN Ohio State Forestry Association has been organized with Mr. W. I. Chamberlain as president, and Professor W. R. Lazenby as secretary.

DR. HERMAN M. BIGGS, medical officer of the health board of the City of New York, lectured at the College of the City of New York, on January 5, his subject being 'The Health of the City of New York.'

SIR OLIVER LODGE lectured at the University of Birmingham on 'Radium and its Meaning,' on January 5, Mr. Joseph Chamberlain, the chancellor of the university, presiding.

MR. GIFFORD PINCHOT, chief of the Bureau of Forestry, will attend the meetings of the National Live Stock Association and the National Woolgrowers' Association, which will be held at Portland, Ore., from January 11–15, in order to learn the sentiment of these associations in regard to the policy of forest reserves.

PROFESSOR RUSSELL H. CHITTENDEN, director of the Sheffield Scientific School of Yale University, has announced the thirty-eighth Course of Sheffield Lectures for 1904. The list of subjects and speakers is as follows:

January 15. 'The Tower of Pelée: New Researches in Martinique': Professor Angelo Heilprin.

January 22. 'Triumphs of Engineering': Mr. Frank W. Skinner, C.E.

January 29. 'Expeditions among the Rockies of British Columbia; a Reconnaissance for the Platinum Metals': Mr. Howard W. DuBois, M.E.

February 5. 'Around the World in Search of the Unexpected': Mr. Horace Fletcher.

February 12. 'Recent Archeological Discoveries in Northwestern America': Mr. Harlan I. Smith.

February 19. 'Wireless Telegraphy': Professor M. I. Pupin.

February 26. 'Comets': Professor Frederick L. Chase.

March 4. 'The Revolutionary Movement in the Philippines': Capt. John R. M. Taylor, U.S.A.

March 11. 'Electrochemistry at Niagara Falls': Professor C. F. Chandler.

March 18. 'Radio-activity': Professor Ernest Rutherford.

PROFESSOR KARL ALFRED VON ZITTEL, the eminent paleontologist of the University of Munich, died on January 6.

MR. HENRY W. LOTHROP, a student of entomology, died at Providence, R. I., on January 5, at the age of sixty years.

MR. BEVERLY BURTON, an American chemist, who has resided in Munich for a number of years, died in that city on January 5.

A CIVIL service examination will be held on February 3 and 4 to fill vacancies in the position of civil engineer in the Philippine services at salaries of $1,400 and $1,800.

THE House of Representatives has appropriated $250,000 toward the eradication of the cotton boll weevil.

THE will of Peter B. Brigham, of Boston, leaving $5,000,000 to the Brigham Hospital, has been sustained by the court.

JOHN WILLIAM CUDWORTH has bequeathed about £70,000 to the Dr. Pusey Library, Oxford.

HERR A. SAMSON has bequeathed to the Munich Academy of Science 500,000 Marks for research in scientific ethics.

THE *Electrical World* states that in order to celebrate the twenty-fifth anniversary of the introduction and commercial development of

the incandescent lamp, the friends and associates of Mr. Thomas A. Edison have taken steps to found a medal which will be entrusted to the American Institute of Electrical Engineers. The circular which is being issued by the Edison Medal Asociation announces that it is the intention that the medals shall be awarded each year to the graduating student who shall present the best thesis on some original subject from the universities and colleges of the United States and Canada which have regular courses in electrical engineering. It is proposed that the medal shall be executed by some artist of distinction and that if possible a permanent fund of about $5,000 shall be established for its maintenance. It is proposed to present the medal fund at the annual dinner of the institute on February 11, which is Mr. Edison's birthday.

We learn from *Nature* that the Venetian Academy of Sciences, Letters and Arts, offers prizes of 3,000 lire under the Querini-Stampaglia foundation for monographs on the following subjects: The lakes of Venetian district, treated from a physiographic and biological standpoint; the works of Manuzi as a critic of Greek and Latin literature; the origins of Venetian painting; and advances in the projective geometry of algebraic surfaces of two dimensions in space of n dimensions. Under the Cavalli foundation, a similar prize is offered for an essay on the effects of modern social and economic conditions, etc., on landlords and farmers, with especial reference to the Venetian provinces. Under the Balbi Valier foundation an award of the same amount is offered for advances in medicine or surgery for the period 1902–3, and under the Minich foundation a prize of 3,000 lire is offered for embryological researches on the development of the larynx, the trachea and the lungs in vertebrates and birds.

In his annual message Governor Odell, of New York, writes as follows in regard to the New York State School of Forestry: "By Chapter 122 of the Laws of 1898 the State purchased Townships 23 and 26 in the County of Franklin, and Cornell University thereupon took title and undertook practical demonstration and instruction in the School of Forestry. Its operations had for their object the substitution for so-called worthless timber of valuable growths, but this has resulted in the practical destruction of all trees upon the lands where the experiment was in progress. No compensating benefits seem possible to the present generation. The preservation of the forests is primarily for the protection of the water supply, and this is not possible through the denudation of the lands. Therefore this school failed of its object, as understood by its founders, a failure which was not due, however, to the work of the university, which followed out the letter and spirit of the law. The report of the committee of the assembly at the last session of the legislature, and the knowledge of the disapproval of many of our citizens, led me to veto the item for its support in the appropriation bill of 1903. The question, therefore, is before you, and to the legislature we must accordingly look for such action as will properly protect all interests. Cornell University undertook this work at the request of the state, and as such was its agent. In so doing it has made contracts for which it is primarily responsible, but which responsibility as the agent of the commonwealth it should not be called upon to assume. Neither should the school it founded be discontinued, because with the lapse of years a proper understanding of scientific forestry will become more and more a necessity. This is particularly true of farm forestry, which will form an important part in the future of agriculture within the state. That our people do not desire, however, that public lands shall be denuded is beyond question. It would seem, therefore, desirable that immediate legislation be had to recover to the state this property, of which there are about 30,000 acres, and for the payment into the treasury of the unexpended portion of the captital fund advanced by the state. Permission should be given to clear up and remove all cut timber and wood by the university, so that the danger of fire may be lessened. The contracts made between Cornell and the Brooklyn Cooperage Company might be left with the executive for adjustment, and failing in this either to the Court of Claims, if the state

is to be the party defendant, or to the Supreme Court if Cornell should be the responsible defendant. In neither case, however, should any burden be placed upon the university.

MR. JAMES BOYLE, U. S. Consul at Liverpool, England, writes to the Department of State that the British government has taken the first step toward the adoption of the decimal system of weights. It has just been announced by the Board of Trade that, under a special order in council, it will sanction the use of a weight of 50 pounds, instead of the present standards of 112 pounds (called a hundredweight) and 56 pounds (called a half hundredweight). The 50 pounds is by this action made a legal standard of weight. This reform has been adopted after forty years of agitation by Liverpool merchants and later on by petitions to the government by the chambers of commerce throughout the country, and particularly by the chamber of commerce of this city. Liverpool has felt the necessity for the change more than any other city, as this is the leading entrepôt for American and colonial produce of bulk, the weighing of which is a considerable item in the handling and, indeed, in the ultimate cost of the shipments. More cotton, corn, provisions and tobacco are imported into Liverpool than into any other city in the world, and by far the largest proportion of these imports come from the United States; so the United States is peculiarly interested in the reform just instituted. The Liverpool *Journal of Commerce* comments approvingly as follows:

> All these great quantities are calculated by the American sellers in pounds avoirdupois, but by the British buyers they have had to be counted in hundredweights, quarters, and pounds, in accordance with our antiquated and absurd and anomalous system of weights. What is the consequence? To give a concrete example: The buyer wishes to ascertain, say, the weight of 100 pounds of tobacco; to do so the nearest weight he can employ is a quarter, or 56 pounds, to which must be added smaller weights until the exact quantity is ascertained. But two 50-pound weights will give him the exact amount at once; three will give him the weight of 150 pounds, four 200 pounds, and so on, smaller weights being used for fractions of 50 pounds. The consequence is an enormous simplification of calculation. It should be remembered that the men who weigh these materials at the docks are not, as a rule, mathematicians who can tell the time of day by algebra. They are largely day laborers, who have not had a superior education, and to weigh quantities with a set of weights necessitating the calculation of fractions of pounds, and thereby the use of dozens of small weights, necessitates a mental effort of which all are not capable, and the use of a multiplicity of weights which confuses them leads to errors and loss of time—and time is money. But by the adoption of a 50-pound weight a unit of calculation has been obtained which will sweep away a whole set of weights, prevent errors, and save confusion, time and money. It should be remembered that the present complicated and wasteful method of calculating weigths has to be gone through four times—first, when the goods are warehoused; second, by the customs, for the purpose of duty; third, in the counting-house; and fourth, in the factory—and in all these cases the same cumbrous system of calculation by hundredweights, quarters and pounds has to be gone through, and the loss of time, convenience and money quadrupled. But by the adoption of a 50-pound weight, though four separate calculations will still be necessary, they can be done simply and quickly. The savings in bookkeeping will alone be great. The present system necessitates a maze of figures of different denominations; but by their reduction to the one common denominator of pounds weight whole columns of figures will be saved and the risk of mistakes minimized.

Americans have great difficulty in understanding the English system of weights—almost as much as they encounter in trying to understand the English fractional system of coinage. For instance, if you ask a man here how much he weighs he will tell you, say, '11 stone 7.' A 'stone' is 14 pounds; so 11 stone would be 154 pounds, and adding the extra 7 pounds the weight given would be 161 pounds. Even Englishmen 'to the manner born' have to make a mental calculation in arriving at the result in pounds in such a case. Sometimes provisions and other articles are sold at so much a stone, and then if the quantity purchased weighs a few odd pounds over a stone or a number of stones the purchaser and seller have to figure out the price per pound. It is the hope and expectation that the results from the adoption of the new

standard weight of 50 pounds will be so satisfactory that before long the old-fashioned 'hundredweight' of 112 pounds will be entirely abolished along with the stone, and that a decimal fractional system of 5 pounds, 10 pounds, and 25 pounds will come into general use.

We learn from the London *Times* that the first meeting for the session of the Geologists' Association, held recently, took the form of a *conversazione,* held in the library of University College, London. The most important geological exhibits were the erratics from Hertfordshire, and the facetted pebbles from Berkshire and Oxfordshire, shown by Dr. Salter; the Hertfordshire pudding-stones by Mr. Green, and the iron, flint and lime concretions, closely resembling animal forms, sent by Dr. Abbitt. The small erratics are of great interest, as it is not easy to account for the presence of rhomboid porphyry of Norwegian origin on the uplands of Hertfordshire. On this subject Dr. Salter intends to publish a paper, advancing another theory than that generally accepted—the transportation by ice across the North Sea. The facetted pebbles of banded quartzite were probably worn down by a natural sand-blast. Anthropology was well represented. The Rev. R. Ashington Bullen showed prehistoric implements; as did Mr. Elliott, whose exhibits included photographs of and implements from the Mentone caves. Among the other exhibits were worked Chinese jade, collections of fossil mollusca, photographs and maps, and other objects of interest to students of geology.

The following books have recently been sold at auction in London: 'Catalogue of the Birds in the British Museum,' from Vol. 1 to Vol. 27, 1874–95, with numerous beautifully-colored plates, £32; the *Ibis,* from 1859 to 1903, with numerous colored plates and the general index, 1877–94, £60; 'Colored Figures of the Birds of the British Islands,' 1891–97, second edition, £63; H. E. Dresser, 'History of the Birds of Europe,' published by the author, 1871–96, with numerous colored plates, £61; two by John Gould, 'The Birds of Great Britain,' 1873, £58; 'Birds of Asia,' 1850–83, £75; 'English Botany,' 1790–94, 36 volumes, £18 15s.; W. C. Hewitson, 'Exotic Butterflies,' 1876, £19.

UNIVERSITY AND EDUCATIONAL NEWS.

Cornell University will receive more than $200,000 from the estate of the late Frederick W. Guiteau of Irvington-on-the-Hudson, which is nearly $50,000 more than was announced at the time of Mr. Guiteau's death last year. The money will be used as a fund for the assistance of needy students, and will be lent them without interest.

By the will of George Sykes, of Rockville, Conn., a fund of $100,000 is provided for a manual training school.

A new science hall, to cost $100,000 is to be erected at Colgate University. A sum of about $30,000 has been subscribed for the purpose.

The French minister of public instruction has recommended the establishment of a chair of physics at the University of Paris, to which M. Curie will be called.

In the report of the registration of the universities, recently published in Science, the number of students in the graduate school of the University of Michigan was given as 69. We are informed that it was at that time at least 85, and is now nearly 100.

Dr. Charles W. Dabney has accepted the presidency of the University of Cincinnati.

Dr. George Stuart Fullerton, professor of philosophy at the University of Pennsylvania and formerly dean and vice-provost, has been elected professor of philosophy at Columbia University.

At Teachers College, Columbia University, Dr. Edward L. Thorndike was promoted from an adjunct professorship to a professorship of psychology; Dr. J. H. MacVannell from an instructorship to an adjunct professorship in education, and Dr. Herman Vulté from a lectureship to an adjunct professorship of domestic science.

Mr. Gilbert Van Ingen has been appointed assistant in geology and curator in invertebrate paleontology at Princeton University.

Mr. Howard D. Minchin, of the University of Michigan, has been appointed instructor in physics at Rochester University.